FINAL

RECORD OF DECISION AMENDMENT
FOR OPERABLE UNIT 4 SILOS 1 AND 2 REMEDIAL ACTIONS

AT THE
UNITED STATES DEPARTMENT OF ENERGY
FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

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Revision 0

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By Fluor Fernald, Inc.

FERNALD
Environmental Management Project

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REVISION 0

William E. Murphie Director Ohio Office, Office of Site Closure, United States Department of Energy	Date

William E. Muno, Director Superfund Division United States Environmental Protection Agency – Region V	Date

DECLARATION STATEMENT

SITE NAME AND LOCATION

Fernald Environmental Management Project (FEMP) Site -- Operable Unit 4 (OU4), Silos 1 and 2 material, Fernald, Hamilton County, Ohio.

STATEMENT OF BASIS AND PURPOSE

This Record of Decision Amendment for Remedial Actions at Silos 1 and 2 [hereinafter called "the ROD Amendment"] addresses the re-evaluation of the treatment component of the selected remedy for the remediation of the OU4 Silos 1 and 2 material at the FEMP Site in Fernald, Ohio. The remedial action (RA) identified in this ROD Amendment was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 Code of Federal Regulations (CFR) Part 300].

The selected remedy outlined in the OU4 ROD (EPA 1994) consisted of the removal of the contents of Silos 1, 2, and 3; remediation by vitrification and off-site disposal of the treated material at the Nevada Test Site (NTS); and the demolition, removal and final disposition of the contaminated concrete, debris, and soils within the OU4 boundary, in accordance with the OU3 and OU5 RODs. In July 1997, the EPA directed DOE-FEMP to develop a supplemental Feasibility Study/Proposed Plan (FS/PP) and subsequent ROD Amendment to reevaluate the treatment remedy for the Silos 1 and 2 material. In accordance with the same agreement, an Explanation of Significant Differences (ESD) was prepared (FEMP 1998a) documenting the change in remedy for Silo 3 material. The scope of this ROD Amendment is limited to revising the treatment portion of the selected remedy for the Silos 1 and 2 material.

The decision presented herein is based on the information available in the administrative record for OU4, which is maintained in accordance with CERCLA. The major documents prepared through the CERLCA process include the Remedial Investigation (RI), the Feasibility Study (FS), the Proposed Plan (PP), and the ROD for OU4, and the revised FS and PP for the Silos 1 and 2 material. This decision also considered state and stakeholder input, including input received during the public hearing held in Fernald, Ohio and the public meeting held in Las Vegas, Nevada following the issuance of the revised FS and revised PP for Silos 1 and 2 material. DOE has considered all comments received during the public comment period on the revised FS and revised PP for Silos 1 and 2 material in the preparation of this ROD Amendment.

The State of Ohio concurs with the remedy and the applicable or relevant and appropriate requirements (ARARs) put forth in this ROD Amendment for the remediation of OU4 Silos 1 and 2 material.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from OU4, if not addressed by implementing the response action selected in this ROD Amendment, may present an imminent and substantial endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

On the basis of the evaluation conducted on the final alternatives as part of the revised FS/PP, the selected remedy identified in the OU4 ROD addressing Silos 1 and 2 material at the FEMP has been modified to the following:

- Complete removal of contents of Silos 1 and 2 and the Decant Sump Tank System sludge from the Transfer Tank Area (TTA) followed by treatment using chemical stabilization to stabilize characteristic metals to meet Resource Conservation and Recovery Act (RCRA), as amended, toxicity characteristic limits and attain the Nevada Test Site (NTS) waste acceptance criteria (WAC).

- Gross decontamination, demolition, size reduction, and packaging of concrete from Silos 1 and 2 structures followed by shipment for off-site disposal at the NTS or an appropriately permitted commercial disposal facility (PCDF).

- Disposal of contaminated soil and debris, excluding concrete from Silos 1 and 2 structures, in accordance with the FEMP On-site Disposal Facility (OSDF) WAC or an appropriate off-site disposal facility, such as the NTS or a PCDF.

In addition, the selected remedy includes the following components, which were not reevaluated, and remain as documented in the OU4 ROD:

- Off-site shipment and disposal of the chemically stabilized waste at the NTS.

- Decontamination and dismantlement (D&D) of all structures and remediation facilities in accordance with the OU3 ROD.

- Removal of the earthen berms and excavation of the contaminated soils within the OU4 boundary, to achieve the remediation levels outlined in the OU5 ROD.

- Appropriate treatment and disposal of all secondary wastes at either the NTS or an appropriate PCDF.

- Collection of perched water encountered during remedial activities for treatment at OU5 water treatment facilities.

- Continued access controls and maintenance and monitoring of the stored waste inventories.

- Institutional controls of the OU4 area such as deed and land-use restrictions.

The FEMP OSDF will be available for disposal of debris from Silos 3 and 4 and associated facilities (the silo superstructures and the Radon Treatment System). Soil and debris from D&D activities associated with these facilities will be disposed in the OSDF if they meet the WAC for disposal. Any soils and debris that do not satisfy the OSDF WAC will be disposed at the NTS or a PCDF.

The concrete from Silos 1 and 2 is more appropriately managed in the same manner as "Category C, Processed-related Metals." This is due to its prolonged contact with the Silos 1 and 2 material, the likelihood of contaminant migration to the interior of the concrete, and the uncertainty in the ability to adequately decontaminate it. Therefore, concrete from Silos 1 and 2 is excluded from disposal at the FEMP OSDF. The interior surface of Silos 1 and 2 will be gross decontaminated to remove visible Silos 1 and 2 material before the structures are demolished, size reduced, and packaged for off-site disposal.

Based on the current operating schedule, however, the FEMP OSDF will not be available for disposal of soil and debris generated from D&D of the OU4 remediation facilities, which include the Decant Sump Tank System, other below-grade appurtenances, and OU4 Area 7 soils. Therefore, the revised FS and PP assumed for costing purposes that all soil and debris from D&D of the OU4 remediation facilities, including treatment facilities, TTA, Radon Control System (RCS), and Pilot Plant, will be disposed at the NTS. However, should programmatic changes occur and the OSDF become available, soil and debris meeting the OSDF WAC will be disposed in the OSDF.

In reaching the decision to implement this remedial alternative, chemical stabilization and vitrification were identified for detailed analysis in the revised FS based upon screening of a wide range of potential treatment alternatives.

A description of the alternatives selected for detailed analysis is provided in Section 3 of the revised FS, which is available in the Administrative Record. The alternatives were evaluated using the nine criteria specified by the NCP in 40 CFR Part 300. A comparison of the alternatives against the nine criteria is presented in **Section 5** of this ROD Amendment. The selected remedy satisfies both of the threshold criteria specified by the NCP and represents the best balance between the alternatives with respect to the five primary balancing criteria.

This remedy will achieve substantial risk reduction by removing the sources of contamination, treating the material that poses the highest risk, shipping the treated material off-site for disposal, and managing the remaining contaminated soils and debris consistent with the site-wide strategy for the FEMP. The selected alternative provides treatment to substantially reduce the mobility of the constituents of concern present in the Silos 1 and 2 material. The selected remedy also provides a high degree of long-term protectiveness for human health and the environment.

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STATUTORY DETERMINATIONS

As documented in **Section 7** of this ROD Amendment, the selected remedy satisfies the statutory requirements specified by the NCP [40 CFR Section 300.430(f)(5)(ii)]. The selected remedy is protective of human health and the environment, complies with all federal and state requirements that are applicable or relevant and appropriate to the RA, and is cost effective. This remedy uses permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable, and satisfies the statutory preference for remedies that employ treatment, and also reduce toxicity, mobility, or volume as a principal element. This remedy will result in contaminated debris and soil being dispositioned in accordance with the EPA-approved RODs for OU3 and OU5, respectively. This remedy may result in pollutants or contaminants, as defined by CERCLA, (i.e., contaminated soil and debris in the OSDF) remaining on-site, above health-based levels. Therefore, a review will be conducted every five years after commencement of RA to ensure that the remedy continues to provide adequate protection of human health and the environment.

All practical means to avoid or minimize environmental harm resulting from implementation of the selected remedy have been adopted. During excavation activities, sediment controls will be implemented to reduce the possibility of potential surface water runoff and sediment deposition to Paddys Run. Final site layout and design will include all practicable means (e.g., sound engineering practices and proper construction practices) to minimize environmental impacts.

In the OU4 ROD, DOE chose to complete an integrated CERCLA/National Environmental Protection Act (NEPA) process. This decision was based on the longstanding interest on the part of local stakeholders to prepare an Environmental Impact Statement (EIS) on the restoration activities at the FEMP and on the recognition that the draft document was issued and public comments received. Therefore, the document served as DOE’s ROD for OU4 under both CERCLA and NEPA; however, it is not the intent of the DOE to make a statement on the legal applicability of NEPA to CERLCA actions.

Under NEPA, DOE is required to prepare a Supplemental EIS (SEIS) when it has made a substantial change in a proposed action, or if there are new significant circumstances in the proposed EIS action that are relevant to environmental concerns. Where the decision to prepare a SEIS is unclear, DOE NEPA regulations require the preparation of a "Supplement Analysis" (10 CFR Section 1021.314). The revised Silos 1 and 2 FS and PP also comprised the DOE's draft Supplement Analysis. Both documents were made available for public review and comment. Based upon the results of the Supplement Analysis, DOE has determined that there is no new information regarding the proposed alternatives for remediation of the Silos 1 and 2 material that would constitute a substantial change to the project scope or would be considered 'significant, new information' related to the environmental impacts from the EIS alternatives. Therefore, a SEIS is not required on the remediation of Silos 1 and 2 material.

The public has played a fundamental role in the remedial actions for OU4. DOE will sustain the same level of public involvement throughout the implementation of the Remedial Design/Remedial Action (RD/RA) activities, as was proven effective during the revised FS/PP and ROD Amendment process.

DOE is committed to maintaining public involvement through completion of the Silos 1 and 2 RD/RA activities. Per requirements under the NCP (40 CFR Section 300.435), DOE at a minimum will:

- Upon completion of the final engineering design, prepare a fact sheet describing the RD (40 CFR Section 300.435).

- Provide a public briefing upon completion of the final engineering design and prior to the beginning of the RA (40 CFR Section 300.435).

- Continue to provide project status through the Monthly Progress Briefings.

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ACRONYMS AND ABBREVIATIONS

A - M

ACA	Amended Consent Agreement
AEA	Atomic Energy Act
ARAR	applicable or relevant and appropriate requirement
AWWT	Advanced Wastewater Treatment
CAT	Critical Analysis Team
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act, as amended
CFR	Code of Federal Regulations
CHEM1	Removal, On-site Chemical Stabilization — Cement-based, Off-site Disposal at the NTS
CHEM2	Removal, On-site Chemical Stabilization — Other, Off-site Disposal at the NTS
CMSA	consolidated metropolitan statistical area
COC	constituent of concern
D&D	decontamination and demolition
DOE	U.S. Department of Energy
DOE-FEMP	U.S. Department of Energy-Fernald Environmental Management Project
DOE-NV	U.S. Department of Energy-Nevada Operations Office
DOT	U.S. Department of Transportation
DWPF	Defense Waste Processing Facility
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
FEMP	Fernald Environmental Management Project
FMPC	Feed Materials Production Center
FR	Federal Register
FS	Feasibility Study
FS/PP	Feasibility Study/Proposed Plan
ILCR	incremental lifetime cancer risk
IRT	Independent Review Team
LSA	low specific activity

ACRONYMS AND ABBREVIATIONS (cont.)

N - Z

NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
NTS	Nevada Test Site
O&M	operations and maintenance
OEPA	Ohio Environmental Protection Agency
OSDF	On-site Disposal Facility
OU	operable unit
PCDF	permitted commercial disposal facility
PEIC	Public Environmental Information Center
POP	Proof of Principle
PP	Proposed Plan
RA	remedial action
RCRA	Resource Conservation and Recovery Act, as amended
RI	Remedial Investigation
ROD	Record of Decision
RCS	Radon Control System
RTS	Radon Treatment System
SRS	Savannah River Site
TBC	to be considered
TCLP	Toxicity Characteristic Leaching Procedure
TTA	Transfer Tank Area
TVS	Oak Ridge Transportable Vitrification System
VIT1	Removal, On-site Vitrification — Joule-heated, Off-site Disposal at the NTS
VIT2	Removal, On-site Vitrification — Other, Off-site Disposal at the NTS
VITPP	Vitrification Pilot Plant
WAC	waste acceptance criteria

1.0 INTRODUCTION

1.1 Background

This Record of Decision Amendment for Remedial Actions at Silos 1 and 2 [hereinafter called "the ROD Amendment"] addresses the re-evaluation of the treatment component of the selected remedy for the remediation of the Operable Unit 4 (OU4) Silos 1 and 2 material at the U.S. Department of Energy's (DOE) Fernald Environmental Management Project (FEMP), formerly known as the Feed Materials Production Center (FMPC). Other components of the selected remedy for OU4 have not been reevaluated and remain as documented in the OU4 ROD. The FEMP is a 425-hectare (1,050 acre) former uranium processing facility located in southwestern Ohio approximately 18 miles northwest of the city of Cincinnati (see **Figure 1.1-1**). It is located just north of Fernald, Ohio, a small farming community, and lies on the boundary between Hamilton and Butler Counties. From 1952 until 1989, the FEMP site provided high purity uranium (U) metal products to support United States defense programs. Production was stopped due to declining demand and a recognized need to commit available resources to remediation. The FEMP site is included on the National Priorities List (NPL) of the U. S. Environmental Protection Agency (EPA). Inclusion on the NPL reflects the importance placed by the federal government on ensuring the expedient completion of cleanup operations at the FEMP. DOE owns the facility and is conducting cleanup activities at the site under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended, and the DOE Environmental Restoration and Waste Management Program. The EPA and the Ohio Environmental Protection Agency (OEPA) support the DOE. Together, the three agencies actively promote local community and public involvement in the decision making process regarding the remediation of the FEMP site.

FIGURE 1.1-1
FEMP FACILITY LOCATION MAP

1.2 OU4 Record of Decision

The decision documented by the OU4 ROD (EPA 1994) was based on the information available in the Administrative Record for OU4 and maintained in accordance with the CERCLA. The documents prepared through the CERCLA process include the Remedial Investigation (RI) [FEMP 1993a], the Feasibility Study (FS) [FEMP 1994a], and the Proposed Plan (PP) [FEMP 1994b] for OU4.

It is DOE policy to integrate the National Environmental Protection Act of 1969 (NEPA) into the procedural and documentation requirements of CERCLA whenever practical. The OU4 ROD and the other CERCLA documentation (RI, FS and PP) supporting remedial efforts at the FEMP site (including OU4) also include the appropriate NEPA evaluations. These integrated CERLCA/NEPA evaluations considered the potential impacts from remedial activities at the FEMP. The OU4 FS/PP-Environmental Impact Statement (EIS) [FEMP 1993b] and subsequent OU4 ROD served as U.S. Department of Energy-Fernald Environmental Management Project's (DOE-FEMP) ROD for OU4 under the CERCLA and NEPA. It was not the intent of the DOE-FEMP to make a statement on the legal applicability of NEPA to CERCLA actions.

The original remedy of vitrification was selected with consideration of stakeholder input including input received from public hearings held on March 21, 1994, in Harrison, Ohio and on May 11, 1994, in Las Vegas, Nevada and written comments received during the formal comment period. The OU4 ROD was approved by the EPA in December 1994.

1.3 Reason for Record of Decision Amendment

Pursuant to Section 117 of CERCLA and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 Code of Federal Regulations (CFR) Section 300.435(c)(2)(ii), a ROD Amendment should be proposed when “differences in the remedial or enforcement action, settlement, or consent decree fundamentally alter the basic features of the selected remedy with respect to scope, performance, or cost.”

The EPA determined that a ROD Amendment for the Silos 1 and 2 material was required, because of a significant cost increase associated with implementing the selected treatment remedy. The EPA determined that although some increase in remedial cost can be reasonably expected, the anticipated cost increase to implement joule-heated vitrification for treatment of the Silos 1 and 2 material constituted a fundamental change to the selected remedy and required a re-examination of the selected remedy and a ROD Amendment (EPA 1997a). DOE is issuing this ROD Amendment in accordance with the NCP [40 CFR Section 300.430(f)(5)].

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The *Revised Feasibility Study Report for Silos 1 and 2* (FEMP 1999a) [hereinafter referred to as the revised FS] and the *Revised Proposed Plan for Silos 1 and 2* (FEMP 1999b) [hereinafter referred to as the revised PP] included the DOE's NEPA Supplement Analysis. The revised FS and PP documents were made available for public review and comment. Under NEPA (10 CFR Part 1021), DOE is required to prepare a Supplemental EIS (SEIS) when it has made a substantial change in a proposed action, or if there are new significant circumstances in the proposed EIS action that are relevant to environmental concerns. Where the need to prepare a SEIS is unclear, DOE NEPA regulations require the preparation of a "Supplement Analysis" (10 CFR Section 1021.314). Based upon the results of the Supplement Analysis for Silos 1 and 2, DOE has determined there is no new information regarding the proposed alternatives for remediation of the Silos 1 and 2 material that would constitute a substantial change to the project scope or would be considered 'significant, new information' related to the environmental impacts from the EIS alternatives. Therefore, a SEIS is not required in order to amend the decision on the remediation of Silos 1 and 2 material.

This ROD Amendment summarizes key information that can be found in greater detail in the RI (FEMP 1993a), FS (FEMP 1994a), PP (FEMP 1994b), revised FS and revised PP. Details on obtaining information relevant to the Silos 1 and 2 remedial selection process is provided in **Section 8.2**.

This ROD Amendment, along with the revised FS, revised PP and supporting documents, are part of the Administrative Record in accordance with to 40 CFR Section 300.825(a)(2).

<END OF SECTION>

2.0 SITE BACKGROUND

This section provides a brief summary of the history of the FEMP and description of OU4. A more detailed discussion can be found in Section 1 and Section F.2 of Appendix F of the revised FS.

The FEMP site was constructed from 1950 to 1951 under the authority of the Atomic Energy Commission, eventually known as the DOE. Between 1952 and 1989, the DOE-FEMP facility (then called the FMPC) produced high purity uranium metal products for the nation's defense programs. Production ceased in the summer of 1989 due to a declining demand for uranium feed product; and, plant activities turned their focus to environmental cleanup. In June 1991, the site was officially closed for production by an act of Congress. To reflect a new mission focused on environmental restoration, the name of the facility was changed to the FEMP in August 1991.

Production operations at the facility were limited to a fenced 55-hectare (136-acre) tract of land, now known as the former Production Area, located near the center of the FEMP site. Large quantities of liquid and solid materials were generated during production operations. Before 1984, solid and slurried materials from uranium processing were stored or disposed in the on-property Waste Storage Area. This area, located west of the former Production Area, includes six low-level radioactive waste storage pits; two earthen-bermed, concrete silos containing a total of 8,012 yd^3 of 11(e)(2) by-product material and 878 yd^3 of a protective BentoGrout™ clay (Silos 1 and 2); one concrete silo containing 5,088 yd^3 of cold metal oxides (Silo 3); one unused concrete silo (Silo 4); two lime sludge ponds; a burn pit; a clearwell; and a solid waste landfill (see **Figure 2.1-1**).

FIGURE 2.1-1

WASTE STORAGE AREA

In order to establish the legal framework by which to address the releases and threats of hazardous substances from containers and facilities at the FEMP, the DOE-FEMP (as the lead agency for the remediation of the FEMP site) and the EPA entered into a Consent Agreement in 1990, as amended (EPA 1991). The Consent Agreement as Amended Under CERCLA Sections 120 and 106(a) (ACA) is the legal basis that administratively governs the proper management and restoration of the FEMP site.

The facility and associated environmental issues of the FEMP site are being managed as five operable units (OUs) in order to promote a more structured and expeditious cleanup. An "OU" is a term employed under federal environmental regulation to represent a logical grouping of environmental issues at a cleanup site. Separate RI/FS documentation was prepared and issued for the five OUs at the FEMP. The five OUs, for which RI/FS documents have been compiled, are defined within the ACA as:

- OU1: Waste Pits 1 through 6, the Clearwell, burn pit, berms, liners, and soil to a determined depth (estimated to be approximately 3 feet) beneath the waste pits.

- OU2: Other waste units including the flyash piles, other South Field disposal areas, lime sludge ponds, solid waste landfills, berms, liners, and soil within the OU boundary.

- OU3: Former production area and production-associated facilities and equipment (includes all above- and below-grade improvements). This includes, but is not limited to: all structures, equipment, utilities, drums, tanks, solid waste, waste product, thorium (Th), effluent lines, a portion of the Silos 1 and 2 material transfer line, wastewater treatment facilities, fire training facilities, scrap metal piles, feedstocks, and the coal pile.

- OU4: Silos 1, 2, 3, and 4, their contents, berms, and Decant Sump Tank System; Radon Treatment System (RTS); a portion of concrete trench and Silos 1 and 2 material transfer line within the boundary of OU4; miscellaneous pads and concrete structures; soils beneath and immediately surrounding Silos 1 through 4; and, perched groundwater in the vicinity of the silos that may be encountered during the implementation of cleanup activities.

- OU5: Environmental media including groundwater (both perched and the Great Miami Aquifer), surface water, soil not included in the definitions of OUs 1 through 4, sediment, flora, and fauna.

All five OUs (including OU4) completed the RI/FS process and have initiated remedial actions (RAs) in accordance with their respective EPA-approved final RODs. The original selected remedy for Silos 1 and 2 within OU4 is being modified through this ROD Amendment.

2.1 Contents of Silos 1 and 2

Silos 1 and 2 contain a total of 8,012 yd^3 of 11(e)(2) by-product material and a total of 878 yd^3 of BentoGrout™ clay for a total volume of 8,890 yd^3. The BentoGrout™ clay layer was added in 1991 to the Silo 1 and 2 material in order to reduce the radon (Rn) emanation. Radionuclides at significant activity levels within these silos are actinium (Ac), radium (Ra)-226, Th-230, polonium (Po)-210, and a radioactive isotope of lead (Pb-210). These radionuclides are naturally occurring elements found in the original ores processed at the FEMP and Mallinckrodt.

Non-radiological constituents detected in significant concentrations in Silos 1 and 2 material include sodium, magnesium, nickel, barium, lead, calcium, iron, and tributyl phosphate (a solvent used in the former uranium extraction process at the FEMP). Tests performed on samples of stored material identified that lead can leach from the untreated material in concentrations that exceed typical federal guidelines for hazardous wastes.

The significant concerns associated with the Silos 1 and 2 material include:

- High concentrations of radionuclides, including Ra-226 and Th-230, that are present in the material;
- An elevated, gamma radiation field in the vicinity of the silos due to the material in the silos;
- Chronic emissions of Rn-222 (a radioactive gas from the decay of Ra-226) from Silos 1 and 2 material into the atmosphere;
- The structural instability of the silos dome and the age of the remaining portions of the structures; and
- The potential threat of the silos material leaching Resource Conservation and Recovery Act, as amended (RCRA) metals and radionuclides into the underlying sole-source aquifer.

2.1.1 Regulatory Classification of Silos 1 and 2 Material

Silos 1 and 2, known as the "K-65 Silos," contain material generated from the processing of high-grade uranium ores termed pitchblende. This processing was performed to extract the uranium compounds from the natural ores. The Silos 1 and 2 material contains high activity concentrations of radionuclides, including Ra-226 and Th-230. The Silos 1 and 2 material was generated consequential to the processing of natural uranium ores and is therefore classified as by-product material, as defined in Section 11(e)(2) of the Atomic Energy Act, as amended (AEA).

The Silos 1 and 2 material is a complex wasteform from a regulatory perspective. Applicable or relevant and appropriate requirements (ARARs) for its remediation are identified in **Appendix A** of this ROD Amendment.

The material contained in Silos 1 and 2 is 11(e)(2) by-product material resulting from the processing of uranium ore concentrates. It is specifically exempt, as defined, from regulation as solid waste under the RCRA 40 CFR Section 261.4(a)(4). The referenced exclusion applies to "... source, special nuclear or by-product material as defined in the Atomic Energy Act of 1954 as amended, 42 U.S.C. 2011, *et seq*." Since a material must first be a solid waste in order to be a hazardous waste, and since the silos material is excluded from regulation as solid waste, the Silos 1 and 2 material cannot be regulated as hazardous waste under RCRA. Although the leachability of lead in the Silos 1 and 2 material exceeds the RCRA toxicity characteristic level, this does not cause the material to become subject to RCRA regulation, due to a hazardous waste characteristic. The metals are not from an external source, but are associated with the parent material [whose residues, including any ancillary metals, are excluded from the definition of solid waste pursuant to 40 CFR Section 261.4(a)(4)].

2.1.2 Packaging and Transportation of Treated Silos 1 and 2 Material

The Silos 1 and 2 material and secondary waste will be subject to regulations under the U.S. Department of Transportation (DOT) 49 CFR Subtitle B Chapter I Subchapter C, *Hazardous Materials Regulations*.

Federal Regulations promulgated by the DOT on September 28, 1995 [60 Federal Register (FR) 50292] categorize low specific activity (LSA) material into three classifications: LSA-I, LSA-II, and LSA-III. Evaluation of the radionuclide content for Silos 1 and 2 material indicates that this material meets one of the criteria for LSA-II material. Specifically, Silos 1 and 2 material is classified as LSA-II because "Class 7 (radioactive) material is essentially uniformly distributed and the average specific activity does not exceed $10^{-4}A_2$/g for solids" (49 CFR Section 173.403).[1] Therefore, the OU4 Silos 1 and 2 material is classified as LSA-II material for proper packaging and transportation.

2.1.3 Disposal of Treated Silos 1 and 2 Material

As discussed in **Section 5**, all alternatives evaluated in the revised FS will dispose the treated Silos 1 and 2 material at the Nevada Test Site (NTS). The NTS is a DOE-owned and managed facility used for the disposal of selected low-level radioactive wastes from other DOE sites.

DOE derives authority from the AEA to manage small quantities of 11(e)(2) by-product material as "low-level waste" so that it may dispose of such small waste quantities at DOE low-level waste disposal facilities (e.g., NTS). Such quantities must not be "too large for acceptance at DOE low-level waste disposal sites," and such wastes must meet the requirements for low-level waste in accordance with DOE Order 435.1 Chapter IV(B)(4).

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[1] The A_2 value is the maximum activity, in curies (Ci), of radioactive material, other than special form, low specific activity (LSA), or surface contaminated objects permitted in a Type A package. To be classified as LSA-II material, the average specific activity must be less than one ten-thousandth (10^{-4}) of the calculated A_2 value per gram of material. As an example, if a material has a calculated A_2 value of 10,000 Ci, the average specific activity must be less than 1 Ci/g.

The treated Silos 1 and 2 material is 11(e)(2) by-product material and may be managed as a low-level waste pursuant to DOE Order 435.1. As a low-level waste, it must meet the NTS waste acceptance criteria (WAC) and, therefore, may not contain a RCRA listed waste, or exhibit a RCRA characteristic, regardless of the exclusion defined for by-product material at 40 CFR Section 261.4(a)(4).

DOE-FEMP will be responsible for demonstrating compliance with the NTS WAC. Specifically, DOE-FEMP will document the absence of the hazardous characteristics defined at 40 CFR Part 261 Subpart C, especially those toxic constituents identified in Table 1 of 40 CFR Section 261.24 that may have been used in a process, regardless of the waste's regulatory status. Upon successful review, the Department of Energy-Nevada (DOE-NV) Radioactive Waste Acceptance Program will document approval of the wastestream.

The CERCLA off-site rule [CERCLA Section 121(d)(3)] and implementing regulations 40 CFR Section 300.440) requires that waste from a RA that is shipped off-site for treatment and/or disposal be transferred only to those receiving units at a facility that (1) are operating in compliance with RCRA and other applicable federal and state requirements, and (2) do not have any uncontrolled releases of hazardous waste or constituents. The rule applies to any RA involving off-site treatment, storage or disposal of CERCLA waste, defined in CERCLA Sections 101(14) and (33); where the RA is being conducted pursuant to CERCLA.

In a letter dated July 7, 1998, the EPA Region IX granted approval to the NTS to dispose of CERCLA waste from DOE facilities in Area 3 and Area 5 Radioactive Waste Management Sites in accordance with the Off-site Rule (40 CFR Section 300.440). EPA Region IX, clarified their position in a letter dated December 4, 1998. The letter states that the CERCLA Off-site Rule approval for the NTS Area 3 and Area 5 Radioactive Waste Management Sites includes management of small volumes of 11(e)(2) by-product materials from Fernald OU4 as low-level waste under the provisions of Chapters III and IV of DOE Order 435.1 or any subsequent applicable DOE directive.

2.1.4 Disposal of Secondary Wastes

The selected remedy includes the decontamination and dismantlement (D&D) of all structures and remediation facilities and appropriate treatment and disposal of all secondary wastes. Secondary wastes generated during the treatment operations of the Silos 1 and 2 material or D&D activities, which cannot be disposed at the NTS without additional treatment, may be treated and/or disposed at an appropriately licensed off-site facility. Concrete from Silos 1 and 2 structures will undergo gross decontamination, demolition, size reduction, and packaging for shipment for off-site disposal at the NTS or an appropriately permitted commercial disposal facility (PCDF). Contaminated soils and debris, excluding concrete from Silos 1 and 2 structures, will be disposed in accordance with either the FEMP On-site Disposal Facility (OSDF) WAC or an appropriate off-site disposal facility, such as the NTS or a PCDF. Perched water encountered during remedial activities will be collected and directed to the FEMP OU5 water treatment facilities.

2.2 Decant Sump Tank System

The Decant Sump Tank System was an integral part of the former operations associated with Silos 1 and 2 and continues to collect groundwater beneath the two silos. Samples collected in 1991 from the water within the Decant Sump Tank System revealed elevated concentrations of Pb-210, Po-210, Ra-226, and U-235. Analytical results also revealed the presence of above-background concentrations of strontium (Sr)-90 and technetium (Tc)-99. With the exception of these latter two constituents, radiological contaminants present in the Decant Sump Tank System are consistent with the relative concentrations of constituents found in Silos 1 and 2. This result confirms that the Decant Sump Tank System is continuing to collect leachate from the underdrains in Silos 1 and 2, as it was designed to do. Sr-90 and Tc-99 were only detected in one decant sump tank sample and the concentrations were only slightly above the contract required detection limits. Sr-90 and Tc-99 are fission products and would not be present in the decant sump tank if the liquids consisted solely of leachate from Silos 1 and 2 collected via the silo underdrains. The presence of these radionuclides may have come from a number of sources other than leaching of radionuclides from the silo contents. These sources include: carry-over of other beta emitters during the laboratory chemical separation process (most probable source); infiltration of meteoric water into the Decant Sump Tank System; cross-contamination of the sample within the transport tanker prior to sample collection; or infiltration of perched groundwater into the decant sump tank.

The metals found in liquid samples from the Decant Sump Tank System include aluminum, antimony, arsenic, chromium, copper, lead, molybdenum, selenium, silver, vanadium, and zinc. In addition, 18 organic compounds were detected in the Decant Sump Tank System liquids at low concentrations. With the exception of toluene, all volatile compounds detected were at or below concentrations that allow a laboratory to accurately quantify the level of the constituents.

2.3 Radon Treatment System

The RTS was installed in November 1987, to reduce the radon inventory within the headspace of Silos 1 and 2. The RTS was sampled during a removal site evaluation in January 1992. Following the addition of BentoGrout™ clay to Silos 1 and 2 during Removal Action 4, the RTS was abandoned in place. The predominant contaminant present is Pb-210 and its associated decay products. Periodic surveys for direct radiation and removable fixed radioactive contamination reveal that only isolated contamination is present in accessible portions of the RTS.

2.4 Contaminated Environmental Media

In addition to the waste areas described, contamination is present in environmental media within the OU4 area, such as surface and subsurface soil, soils within the earthen berm surrounding Silos 1 and 2, groundwater, surface water, and perched water.

2.4.1 Principal Threats of Silos 1 and 2 and Related Systems

The NCP describes principal threats as those involving liquids, areas contaminated with high concentrations of toxic compounds, and highly mobile materials. The OU4 RI provided a detailed characterization of the Silos 1 and 2 material. The OU4 RI identified those contaminants that contributed to an incremental lifetime cancer risk (ILCR) value greater than the CERCLA criterion of 1×10^{-6} and a hazard quotient greater than the CERCLA criterion of 1.0. The OU4 RI identified the principal threats to human health and the environment posed by the Silos 1 and 2 material as being from the following four contaminant/transport pathways:

- Direct radiation
  - Direct exposure to gamma radiation from radioactive constituents within the silos.
  - Direct exposure to gamma radiation from radioactive constituents in surface soil.

- Air emissions
  - Dispersion of radon that escapes from the silos into the atmosphere.
  - Dispersion of volatile organic compounds or fugitive dust generated from soil.

- Surface water runoff
  - Erosion of contaminated soils into Paddys Run from the vicinity of the silos.

- Groundwater transport
  - Leaching of contaminants from the silos contents via soils to underlying groundwater.
  - Leaching of contaminants from the silos contents via soil to a sand silty/clay lens in the glacial till, which could carry contaminants to surface water and sediment in Paddys Run.

Potential remedial alternatives for OU4 were developed in order to mitigate the short-term and long-term exposure and associated risks from gamma radiation; reduce radon emanation rates from the Silos 1 and 2 material; minimize the leachability of contaminants from the waste material; eliminate potential of air dispersion from a silo collapse; eliminate the dispersion of fugitive dust generated from the soil; and, eliminate contaminated surface water runoff from contaminated soils into Paddys Run.

2.4.2 Overview of the Nature and Extent of Contamination

This section summarizes the nature and extent of contamination within environmental media in the OU4 study area. Also included in this section is an overview of the levels of direct radiation associated with the current conditions within OU4. Additional detail on these conditions is provided in Section 4.0 of the OU4 RI (FEMP 1993a).

2.4.2.1 Surface Soils

Sampling performed as part of the RI/FS and other site programs in the vicinity of OU4 indicates the occurrence of above background concentrations of uranium, and to a lesser degree, other radionuclides in the surface soils within and adjacent to the OU4 study area. These above-background concentrations appear to be generally limited to the upper six inches of soil. Available survey data and process knowledge do not indicate a direct relationship between the surface soil contamination in the OU4 study area and the silos contents.

Soil samples were also collected from the soils contained in the earthen embankment (berm) surrounding Silos 1 and 2. The analytical data from the berm fill show only slightly elevated radionuclide activity concentrations.

2.4.2.2 Subsurface Soils

As part of the OU4 RI, samples were collected from the subsurface soils located under and adjacent to Silos 1 and 2. Analytical results revealed elevated concentrations of radionuclides from the uranium decay series in the soils at the interface between the berm and the original ground level. Elevated concentrations (up to 53 pCi/g for U-238, about 40 times background) were also noted in slant boreholes, which passed in close proximity to the silos' underdrains.

2.4.2.3 Groundwater

With the exception of perched groundwater encountered during potential RA, groundwater within the Great Miami Aquifer underlying the silos area is not within the scope of OU4. Groundwater in the Great Miami Aquifer underlying the entire FEMP site is being addressed as part of OU5.

Uranium was the major radionuclide contaminant found in the perched water. Elevated concentrations of total uranium were detected in the slant boreholes under and around Silos 1 and 2.

2.4.2.4 Great Miami Aquifer

The concentration of total uranium in the upper portion of the Great Miami Aquifer, based on analysis of samples from the 2000-series wells, ranged from less than 1 µg/L to 40.3 µg/L. Both upgradient and downgradient wells contain above background concentrations of total uranium. Therefore, other sources of contamination must exist besides Silos 1 and 2.

2.5 Purpose and Need for Decision

Facilities and environmental media at the FEMP site, including OU4, contain radioactive and chemical constituents at levels that exceed certain federal and state standards, and guidelines for protecting human health and the environment. Currently, DOE-FEMP maintains custody of the property and restricts access with fences and security forces, precluding a member of the public from being exposed to site areas that have contamination.

The EPA has established a formalized risk assessment process to determine the necessity for implementation of cleanup actions. Under this process, several hypothetical scenarios that could expose members of the public to site contamination were examined. One of these scenarios assumed that site access was not controlled (i.e., unrestricted) and a member of the public could be exposed to the higher contamination areas. Results of the risk assessment performed for this hypothetical, unrestricted access scenario indicated that an individual establishing residence within the highly contaminated portions of the OU4 area, under existing conditions, would be subjected to an increased risk of incurring an adverse health effect. Risk assessment calculations performed for OU4 indicate the projected level of increased risk exceeds established federal regulatory guidelines. Based on the results of the baseline risk assessment, the DOE-FEMP concluded in the RI (FEMP 1993a) that existing site conditions warrant RA. A summary of the original assessment results can be found in Appendix F of the revised FS (1999a).

2.6 Description of the Original Selected Remedy

Based of the evaluation of remedial alternatives conducted in the FS/PP (FEMP 1994 a,b), the major components of the selected remedy documented in the OU4 ROD (EPA 1994) are as follows:

- Removal of the contents of the Silos 1, 2, 3 and the decant sump tank sludge.
- Treatment of the Silos 1, 2, and 3 material and sludges removed from the silos and the decant sump tank by vitrification to meet disposal facility WAC.
- Off-site shipment of the vitrified contents of Silos 1, 2, 3 and the decant sump tank for disposal at the NTS.
- Demolition of Silos 1, 2, 3 and 4 and decontamination, to the extent practicable, of the concrete rubble, piping, and other generated construction debris.
- Removal of the earthen berms and excavation of the contaminated soils within the boundary of OU4, to achieve remediation levels. Placement of clean backfill to original grade following excavation.

- Demolition of the remediation and support facilities after use. Decontamination or recycling of debris before disposition.

- On-property interim storage of excavated contaminated soils and contaminated debris in a manner consistent with the approved *Work Plan for FEMP Removal Action No. 17 - Improved Storage of Soil and Debris* (DOE 1996)[2], pending final disposition of soil and debris in accordance with the RODs of OUs 5 and 3, respectively.

- Continued access controls and maintenance and monitoring of the stored waste inventories.

- Institutional controls of the OU4 area such as deed and land-use restrictions.

- Potential, additional treatment of stored OU4 soil and debris using OU5 and OU3 waste treatment systems.

- Pumping and treating, as required, of any contaminated perched groundwater encountered during remedial activities.

- Disposal of the OU4 FEMP contaminated debris and soils consistent with the RODs for OUs 3 and 5, respectively.

Although the selected remedy for OU4 specifies on-site disposal for the OU4 soil and debris, the final decision regarding the final disposition of the OU4 debris and soils was placed in abeyance, until the OU3 and OU5 RODs were completed. This approach allowed DOE to take full advantage of planned waste management and treatment strategies developed by these OUs and enabled the integration of disposal decisions for OU4 contaminated soils and debris on a site-wide basis. The integration strategy for the OU4 contaminated soils and debris is discussed in more detail in **Section 4.0**.

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[2] This component of the selected remedy was documented in the Operable Unit 4 Record of Decision (ROD) in 1994. However, for purposes of this ROD Amendment the reference has been updated to the most recent revision.

<END OF SECTION>

3.0 BASIS FOR MODIFYING THE OU4 RECORD OF DECISION

3.1 Basis for ROD Amendment

3.1.1 Technical Basis for the Revised Path Forward

The technical basis for reevaluating the path forward for OU4 remediation, and ultimately modifying the ROD, is presented in detail in Section 1.1 of the revised FS. Following approval of the OU4 ROD, a treatability study program was initiated in May 1996 to collect quantitative performance data to support full-scale application of the joule-heated vitrification technology to the silos material.

During the treatability study program, many technical and operational difficulties were encountered. These technical and operational issues are discussed in detail in Section 1.1 of the revised FS, and in the VITPP Melter Incident Final Report (FEMP 1997b). Attempts to resolve these issues during Vitrification Pilot Plant (VITPP) operations resulted in documented schedule and cost increases.

In September 1996, the DOE requested that the EPA grant an extension of enforceable milestones associated with implementing vitrification of the silos material due to the aforementioned difficulties. In October 1996, the EPA denied DOE's request. Pursuant to the September 1991, Amended Consent Agreement, the EPA and DOE initiated the formal dispute resolution process and began reevaluating the remediation of the silos material. In November 1996, the DOE-FEMP formed the Silos Project Independent Review Team (IRT) as a technical resource to assist the DOE-FEMP in this re-evaluation. The IRT was comprised of technical representatives from throughout the DOE-FEMP complex and private industry with expertise in various aspects of chemical stabilization, vitrification, and other treatment technologies.

During the final stages of the last campaign of the VITPP to demonstrate lower temperature processing (<1200°C) of Silos 1 and 2 material, the melter hardware failed (December 26, 1996).

On July 22, 1997, the DOE-FEMP and the EPA signed an, "Agreement Resolving Dispute Concerning Denial of Request for Extension of Time for Certain OU4 Milestones" (EPA 1997b) [hereafter referred to as "the Settlement"]. The Settlement resolved disputes concerning the schedule and path forward for the remediation of the Silos 1, 2, and 3 materials. In the Settlement, EPA and DOE-FEMP agreed that DOE-FEMP would supplement the FS/PP so as to evaluate vitrification and other alternatives for treatment of the Silos 1 and 2 material. In addition, the EPA determined the remedial actions for Silo 3 could be separated from Silos 1 and 2 and an ESD would be sufficient to document the changes to the Silo 3 remedy.

An ESD was completed by DOE-FEMP and approved by the EPA in March 1998 to document the change in remedy for treatment and disposal of the Silo 3 material (FEMP 1998a).

The DOE-FEMP has prepared a revised FS and revised PP to recommend a RA for the Silos 1 and 2 material. The revised FS and the revised PP were made available for stakeholder review. The revised FS and revised PP provided the basis for selection of the final remedy, which is documented in this amendment to the OU4 ROD, for Silos 1 and 2. In addition, comments received from the OEPA and stakeholders on the revised FS and revised PP are addressed in **Section 6.0** and **Appendix B**, respectively, of this ROD Amendment.

As part of the revised path forward for Silos 1 and 2, a contract was awarded in February 1999 to retrieve the entire contents of Silos 1 and 2 and the Decant Sump Tank System and transfer it to a newly constructed, environmentally controlled Transfer Tank Area (TTA). This allows for storage of the material in a safer configuration than the Silos 1 and 2 structures while pending remediation by the selected treatment alternative. The contract award includes the construction of a radon control system (RCS) in conjunction with the TTA to control Rn-222 emanation during the retrieval and storage of Silos 1 and 2 material in the TTA. In addition, the RCS will control Rn-222 emanation during retrieval, treatment, and storage of Silos 1 and 2 material in the remediation facility.

3.1.2 Regulatory Basis for the ROD Amendment

In the Settlement, EPA directed DOE-FEMP to proceed with the development of a ROD Amendment for the Silos 1 and 2 material and an ESD for the Silo 3 material.

Pursuant with Section 117 of CERCLA and the NCP at 40 CFR Section 300.435(c)(2)(ii), a ROD Amendment should be proposed when "differences in the remedial or enforcement action, settlement, or consent decree fundamentally alter the basic features of the selected remedy [in the ROD] with respect to scope, performance, or cost."

The EPA determined that although some increase in remediation cost can be reasonably expected; in this specific case the final remediation cost estimated by DOE-FEMP for the Silos 1 and 2 material increased significantly [i.e., approximately greater than 3 times the original estimate]. Therefore, it was EPA's position that the significant anticipated cost increase changes - resulting from implementability issues with the treatment technology of joule-heated vitrification for the Silos 1 and 2 material - required a re-examination of the selected remedy and a ROD Amendment (EPA 1997a).

3.1.3 Basis for Modification of the Selected Remedy for Silos 1 and 2 Remedial Actions

This ROD Amendment modifies the treatment component of the selected remedy for Silos 1 and 2 material from vitrification to chemical stabilization. The modification of the treatment component is based on the conclusion that chemical stabilization satisfies both threshold criteria specified by the NCP and meets the statutory requirements of CERCLA. In addition, chemical stabilization attains Remedial Action Objectives identified in the OU4 ROD, and has an overall advantage over vitrification when evaluated against the five primary balancing criteria specified by the NCP. Specifically, the advantages of chemical stabilization in implementability and short-term effectiveness (worker risk and time to achieve protection) are judged to outweigh the advantages of vitrification due to its lower treated waste volume. The basis for this conclusion is presented in detail in **Section 5**. As documented in **Sections 6 and 8**, respectively, state and community acceptance have been addressed in accordance with the NCP.

3.2 Post-ROD Information Base

Since the approval of the OU4 ROD in December 1994 by the EPA, the DOE-FEMP has developed an expanded information base with respect to the various treatment technologies and their application toward the remediation of the Silos 1 and 2 material. This information has been used in the revised FS for the preliminary screening and re-evaluation of treatment technologies for the silos material. The various documents comprising this information base are identified in the revised FS bibliography and are part of in the Administrative Record and are available for inspection.

3.2.1 Vitrification Pilot Plant Final Reports

The FEMP joule-heated VITPP treatability study program consisted of three test campaigns with the following objectives: (1) to determine (using surrogates) whether it was more economical to vitrify the Silos 1, 2, and 3 materials together or separately; (2) to gain experience vitrifying silos material and handling high-sulfate, high-barium and lead concentrations, and BentoGrout™; and (3) to determine maximum production rates through induced agitation (via bubbling tubes) in the molten glass bath to increase production.

The results of the three test campaigns have been published in three separate *Operable Unit 4 Vitrification Pilot Plant* reports - Campaign 1, 3 and 4, respectively (FEMP 1996a, 1996b, 1997a). The results of the testing have been factored into the development of the alternatives' design basis, cost estimates, and the implementability evaluation for the vitrification technologies.

3.2.2 Melter Incident Report

The *VITPP Melter Incident Report* (FEMP 1997b) summarizes the findings of three investigative teams who evaluated the FEMP VITPP melter hardware failure and subsequent leakage of non-radioactive surrogate glass. The report identifies the causal and contributing factors that lead to the melter failure, and identifies lessons learned for any future applications of vitrification technology for the DOE-FEMP silos material or other areas in the DOE complex.

3.2.3 Independent Review Team Report

In November 1996, DOE-FEMP formed the Silos Project IRT to provide recommendations to them and the DOE-FEMP, as an aid in the internal decision process. Specifically, the IRT assisted and advised the DOE, the public and regulatory agencies in recommending a path forward for immobilization and disposal of the materials contained in Silos 1, 2 and 3 in OU4 of the FEMP.

The IRT was composed of 11 members, having backgrounds and experience in several areas including vitrification, glass furnaces and glass making, cementation, projects and project management, regulatory, environmental, and safety.

The IRT performed an independent analysis of the VITPP melter incident and other technical issues associated with the treatment of the Silos 1, 2 and 3 material. Based upon this analysis, the IRT published their final report (Silos Project IRT 1997) which identifies the IRT's recommendations for a path forward for remediation of the Silos 1, 2, and 3 material. The recommendations were based on the information provided through reports, discussions, presentations and site tours, and supplemented by individual knowledge and study.

The IRT was unable to reach unanimous consensus upon a recommended treatment process for the Silos 1 and 2 material. Both the majority and minority opinions are formally documented in the IRT final report.

3.2.4 Waste Vitrification Systems Lessons Learned

In March 1999, the DOE Office of Environment, Safety and Health published a report to present lessons learned in the design and operation of waste vitrification systems (DOE 1999). The report summarizes the joule-heated melter technology experiences from four low level waste vitrification facilities (Fernald VITPP, Savannah River Site (SRS) Vendor Treatment Facility, Oak Ridge Transportable Vitrification System (TVS), and Hanford Low-Level Vitrification Project). The report also summarizes technology experiences from four high-level waste vitrification facilities (SRS Defense Waste Processing Facility (DWPF), West Valley Demonstration Project Vitrification Facility, Sellafield - UK Waste Vitrification Plant, and Savannah River Stir Melter). The lessons learned have been used in the evaluation of the vitrification technologies in Section 3 of the revised FS.

3.2.5 Proof of Principle Testing Final Reports

In accordance with the July 22,1997, dispute settlement between the EPA and DOE-FEMP, the DOE-FEMP performed the Proof of Principle (POP) Testing Project to support the technical basis for the alternatives being evaluated in the revised FS. This testing was scoped and implemented to satisfy agency and stakeholder concerns that the detailed evaluation of the alternatives and comparative analysis be supported by pilot-scale data resulting from testing of proven and commercially available remedial technologies. The testing was performed using non-radioactive surrogates that simulated selected physical and chemical characteristics of the Silos 1 and 2 material.

The technologies of the POP Testing Project were based upon the preliminary screening and technology selection process described in Section 2 of the revised FS. The preliminary screening and technology selection process resulted in the identification of two technology families (vitrification and chemical stabilization) with two alternatives each, for detailed analysis in Section 3 of the revised FS. The following is a list of the technology families/stabilization alternatives evaluated in the revised FS:

- Vitrification – Joule-heated;
- Vitrification – Other;
- Chemical Stabilization – Cement-based; and
- Chemical Stabilization – Other.

3.2.6 U.S. EPA REACHIT Database

In August, 1999, an extensive search was conducted of the EPA's nationwide electronic database (REACHIT) of remedial sites where the vitrification, solidification/stabilization, and chemical stabilization treatment technologies have been applied to the remediation of material contaminated with lead and/or radioactive material. The database search identified a list of facilities where the technologies, at various stages of implementation, have been applied to wastestreams reasonably similar to the Silos 1 and 2 material. The results of the search have been used as part of the implementability evaluation of the technologies in Section 3 of the revised FS.

4.0 DESCRIPTION OF SIGNIFICANT DIFFERENCES OR NEW ALTERNATIVES

4.1 Description of the Originally Selected Remedy

The key components of the selected remedy documented in the OU4 ROD (EPA 1994) are as follows:

- Removal of the contents of the Silos 1, 2, and 3 and the Decant Sump Tank System sludge.
- Treatment of the Silos 1, 2, and 3 material and sludges removed from the silos and the Decant Sump Tank System by vitrification to meet disposal facility WAC.
- Off-site shipment of the vitrified contents of Silos 1, 2, and 3 and the Decant Sump Tank System for disposal at the NTS.
- Demolition of Silos 1, 2, 3 and 4 and decontamination, to the extent practicable, of the concrete rubble, piping, and other generated construction debris.
- Removal of the earthen berms and excavation of the contaminated soils within the boundary of OU4, to achieve remediation levels. Placement of clean backfill to original grade following excavation.
- Demolition of the remediation and support facilities after use. Decontamination or recycling of debris before disposition.
- On-property interim storage of excavated contaminated soils and contaminated debris in a manner consistent with the approved *Work Plan for FEMP Removal Action No. 17 - Improved Storage of Soil and Debris* (DOE 1996), pending final disposition of soil and debris in accordance with the RODs of OUs 5 and 3, respectively.[3]

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[3] This component of the selected remedy was documented in the Operable Unit 4 Record of Decision (ROD) in 1994. However, for purposes of the ROD Amendment the reference has been updated to the most recent revision.

- Continued access controls and maintenance and monitoring of the stored waste inventories.
- Institutional controls of the OU4 area such as deed and land-use restrictions.
- Potential, additional treatment of stored OU4 soil and debris using OU5 and OU3 waste treatment systems.
- Pumping and treating, as required, of any contaminated perched groundwater encountered during remedial activities.
- Disposal of the OU4 FEMP contaminated debris and soils consistent with the RODs for OUs 3 and 5, respectively.

Although the selected remedy documented in the OU4 ROD specifies on-site disposal for the OU4 soil and debris, the final decision regarding the final disposition of the OU4 debris and soils was placed in abeyance, until the OU3 and OU5 RODs were approved by EPA. This approach allowed DOE to take full advantage of planned waste management and treatment strategies by these OUs and enabled the integration of disposal decisions for contaminated soils and debris on a site-wide basis.

4.2 The OU4 Modified Selected Remedy

In accordance with the Settlement, the Silo 3 remedy was separated from Silos 1 and 2 remedy to reduce the technical uncertainties and programmatic risks of developing an effective treatment process for separate wastestreams with significant differences in chemical and physical properties. The change in remedy to chemical stabilization for Silo 3 is documented in an ESD approved by the EPA in March 1998 (FEMP 1998a).

The revised FS/PP reevaluated only the treatment component of the selected remedy for Silos 1 and 2 material. Based on evaluation of the treatment alternatives conducted in the revised FS/PP, the treatment component of the modified selected remedy for Silos 1 and 2 consists of:

- Complete removal of contents of Silos 1 and 2 and the Decant Sump Tank System sludge from the TTA, followed by treatment using chemical stabilization to stabilize characteristic metals to meet RCRA toxicity characteristic limits and attain the NTS WAC.

- Gross decontamination, demolition, size reduction, and packaging of concrete from Silos 1 and 2 structures followed by shipment for off-site disposal at the NTS or an appropriate PCDF.

- Disposal of contaminated soil and debris, excluding concrete from Silos 1 and 2 structures, in accordance with the FEMP OSDF WAC or an appropriate off-site disposal facility, such as the NTS or a PCDF.

The following components of the selected remedy for Silos 1 and 2 material have *not* been reevaluated and remain as documented in the OU4 ROD:

- Off-site shipment and disposal of the chemically stabilized waste at the NTS.
- Decontamination and dismantlement (D&D) of all structures and remediation facilities in accordance with the OU3 ROD.
- Removal of the earthen berms and excavation of the contaminated soils within the OU4 boundary, to achieve remediation levels in the OU5 ROD.
- Appropriate treatment and disposal of all secondary wastes at either the NTS or an appropriate PCDF.
- Collection of perched water encountered during remedial activities for treatment at OU5 water treatment facilities.
- Continued access controls and maintenance and monitoring of the stored waste inventories.
- Institutional controls of the OU4 area such as deed and land-use restrictions.

4.2.1 Removal of Silos 1 and 2 Material and Decant Sump Tank Contents

The material in Silos 1 and 2 and the sludge in the Decant Sump Tank System will be removed and placed in the TTA. Approximately 6,126 m^3 (8,012 yd^3) of 11(e)(2) by-product material and 671 m^3 (878 yd^3) of BentoGrout™ clay from Silos 1 and 2 and 3,785 L (1,000 gallons) of sludge from the decant sump will be removed and placed in the TTA pending treatment by the selected remedy. The TTA will be equipped with a RCS designed to handle radon emissions generated during removal and storage.

4.2.2 Chemical Stabilization of Silos 1 and 2 and Decant Sump Tank Contents

The treatment component of the selected remedy consists of a chemical stabilization system to immobilize the constituents of concern (COCs) in Silos 1 and 2 material and the Decant Sump Tank System. For purposes of this selected remedy, chemical stabilization is defined as a non-thermal treatment process that mixes the Silos 1 and 2 material (including Bentogrout™) with a variety of chemical additive formulations (e.g., lime, pozzolans, gypsum, portland cement, or silicates) to accomplish chemical and physical binding of the COCs. The wastes removed from the TTA will be transferred to a chemical stabilization facility, which will be constructed on-site. The chemical binding of the COCs in the stabilized wasteform reduces their leach rate to meet the NTS WAC. In addition, the stabilized wasteform with sealed containerization reduces radon emanation to meet regulatory standards. Particulate released as a result of the stabilization process will be treated by an air emissions treatment system to satisfy all air emission ARARs and TBCs. Radon emanated during the treatment process will be collected and routed to the TTA RCS.

4.2.3 Off-site Shipment and Disposal of Treated Material

Approximately 20,836 m^3 (27,254 yd^3) to 22,855 m^3 (29,895 yd^3) of stabilized material from Silos 1 and 2 and the Decant Sump Tank System will be generated during the treatment process. Containerization of treated waste to meet DOT shipping requirements and the NTS WAC will result in a disposal volume of approximately 33,144 m^3 (43,352 yd^3) to 36,431 m^3 (47,652 yd^3).

The NTS is a DOE owned and operated disposal site located near Las Vegas, Nevada. The treated waste will either be shipped to the NTS by truck or by intermodal transport (combination rail and truck).

The NTS is located approximately 3,219 kilometers (2,000 miles) from the FEMP. The FEMP has an approved NTS waste shipment and certification program for low-level radioactive waste that is periodically audited by the NTS. Disposal of treated Silos 1 and 2 material will be incorporated into this program. Technical oversight of the waste management activities at the NTS is provided by the State of Nevada.

Off-site shipments will comply with the DOT regulations found in 49 CFR Parts 171-178 pertaining to the transportation of hazardous and radioactive materials. Additionally, the packaged, treated Silos 1 and 2 material will meet the NTS WAC.

4.2.4 Soils and Debris

The OSDF will be available for disposal of debris from the existing Silos 3 and 4 structures and associated facilities (superstructures and RTS). Soil and debris from D&D activities associated with these facilities will be disposed in the OSDF if they meet the OSDF WAC for disposal. Any soils and debris that do not satisfy the OSDF WAC will be disposed at the NTS or an appropriate PCDF.

Criteria for disposal of waste materials into the OSDF are documented in the *Waste Acceptance Criteria Attainment Plan for the On-site Disposal Facility* (FEMP 1998b). The current version was issued in June 1998 following approval by the EPA and Ohio EPA. The OSDF WAC for debris were established in the OU3 ROD (FEMP 1996c). The OSDF WAC Attainment Plan provides that these criteria can be applied to debris for other OUs, including OU4, consistent with provisions of the ROD for each OU.

The OU3 ROD classified debris into ten distinct material categories based upon similar or inherent properties and configuration. Two categories, Category C – Process-related Metals and Category J – Product, Residues, and Special Materials, were administratively excluded from on-site disposal. In evaluating on-site disposal for concrete (Category E), the OU3 ROD focused primarily on structural concrete. The evaluation did not consider the potential impact of prolonged contact with residues or other contaminants, such as a concrete storage silo.

The concrete in Silos 1 and 2 has been in contact with contaminated material for over 30 years. Because of the relatively mobile COCs and the high moisture content associated with the Silos 1 and 2 material, there is a significant potential for migration of contaminants into the concrete. The depth and extent of the migration of the COCs into the concrete and the ability and cost of adequately decontaminating the concrete is uncertain.

Therefore, the concrete from Silos 1 and 2 is excluded from disposal in the OSDF. The concrete from Silos 1 and 2 will undergo gross decontamination followed by demolition, size reduction, and packaging for off-site disposal. Disposal of concrete from Silos 1 and 2 will be at the NTS or an appropriate PCDF.

Based on the current operating schedule, the FEMP OSDF may not be available for disposal of soil and debris generated from D&D of the Silos 1 and 2 remediation facilities. Therefore, for costing purposes, the revised FS and PP assume that all soil and debris from D&D of the OU4 remediation facilities will be disposed at the NTS. However, should programmatic changes occur and the OSDF become available, soil and debris meeting the OSDF WAC would be disposed in the OSDF in the same manner as discussed above for Silos 3 and 4 and associated facilities.

4.2.5 Perched Water

The OU5 RI/FS process examined perched groundwater on a site-wide basis. It should be noted, however, that in accordance with the ACA each OU must address perched groundwater envisioned to be encountered as a consequence of conducting RAs. An example of such an incidence is the collection of perched groundwater in deep excavations completed to remove underground tank systems (Silos 1 and 2 decant sump tank), pits, or foundations. This collected water will be directed to the FEMP OU5 wastewater treatment systems.

Process wastewaters generated during RAs conducted by all OUs will be directed to the OU5 treatment systems [i.e., the Advanced Wastewater Treatment (AWWT) facility]. OU5 has established pretreatment requirements to ensure that incoming wastewater streams do not exceed available treatment capabilities.

4.2.6 Cost

The total estimated cost for implementing the selected remedy that includes using a chemical stabilization technology to treat the Silos 1 and 2 material is approximately three-hundred ($300) million dollars. **Table 4.2-1** summarizes the major cost elements of the two alternative processes that represented the chemical stabilization technology in the revised Silos 1 and 2 FS. The cost estimates were prepared so as to define each cost element based on the preconceptual design specified in the revised Silos 1 and 2 FS. The cost estimates include capital costs, operation and maintenance (O&M) costs, waste shipping and disposal costs, D&D costs, engineering costs, project management costs, and the cost of borrowing money.

TABLE 4.2-1

COST ESTIMATE FOR THE REVISED REMEDY ($ MILLIONS)

Preferred Alternative	Chemical Stabilization	
Process Option	CHEM1	CHEM2
Capital Cost	55	56
Operation and Maintenance Cost	77	83
Waste Shipping and Disposal Cost		
Packaging	34	33
Transportation	14	13
Disposal	10	9
D&D Cost	34	36
Engineering Cost	24	24
Project Management Cost	21	21
Cost of Money	28	28
Summary Cost (un-escalated)	297	303

4.2.7 Measures to Control Environmental Impacts

In accordance with DOE regulations for implementing the NEPA (10 CFR Part 1021), DOE has factored environmental impacts into the decision making process for the OU4 RA. All practical measures will be employed at the FEMP site to minimize environmental impacts to human health and the environment during the implementation of the OU4 RA.

Measures to control environmental impacts will be implemented during RD and the RA to minimize impacts to natural resources (e.g., wildlife and wildlife habitat, cultural resources, wetlands, surface water, groundwater). OU4 remedial activities will not impact floodplain areas at the FEMP. Although the 100 to 500-year floodplain of Paddys Run is located near the silos and associated support facilities, direct physical impact to the floodplain will not occur. The implementation of engineering controls will minimize any indirect impact such as runoff and sediment deposition to the floodplain. In addition, changes in flood elevation will not occur. The following provides is a discussion of the measures that will be taken to minimize impacts to human health and the environment on and adjacent to the FEMP site.

Excavation activities and the construction and operation of the various support facilities (e.g., waste processing facility and storage facility) will result in the disturbance of approximately 1.0 hectare (2.5 acres) of terrestrial and managed field habitat and the potential for increased erosion and sediment loads to surface water (i.e., Paddys Run). However, appropriate engineering controls such as silt fences, vegetative cover, and runoff control systems will be used to minimize runoff to Paddys Run and its associated aquatic habitat, including the state-threatened Sloan's crayfish (orconectes sloanii). In addition, appropriate air emission treatment systems will be used during the operation of the chemical stabilization facility to minimize the potential for increased emissions to the ambient air and resulting impacts to on-site and off-site personnel and to surrounding riparian habitat.

Groundwater, surface water, and air monitoring will be performed before, during, and after remedial activities. If adverse effects are detected in any of these environmental media, work will be immediately stopped until the effects are controlled and/or the appropriate response actions are executed.

The selected remedy for OU4 includes the removal of the contaminated surface soil from the entire OU4 area and re-grading with clean fill material, as required. Therefore, the primary residual contaminant would be uranium, below the final remediation level established in the OU5 ROD (FEMP 1996c) for the subsurface soil. Because the contact of ecological receptors is limited (near background levels) to surface soil and surface waters, residual ecological risks associated with the OU4 preferred alternative would be indistinguishable from those risks posed by background levels in the soil.

<END OF SECTION>

5.0 DESCRIPTION AND EVALUATION OF ALTERNATIVES

5.1 Treatment Alternatives for the Silos 1 and 2 Material

The Detailed Analysis in the revised FS evaluated vitrification and chemical stabilization, using two of the commercially available process options for each treatment technology. Two representative process options were chosen for chemical stabilization and vitrification, in order to provide a balanced analysis of the two technologies against the NCP evaluation criteria. The preconceptual designs used in the revised FS are based upon data and design information developed from POP testing and have been developed as viable ways to remediate the Silos 1 and 2 material. Although two options for each technology were selected for the analysis, equivalent commercially demonstrated processes that are consistent with the selected remedy, will not be precluded from consideration, consistent with the final selected remedy, during remedial design.

In the detailed analysis, no significant differences were identified to provide a compelling reason to select a given process option (i.e., CHEM1 vs. CHEM2, or VIT1 vs. VIT2) over another process option. For this reason, the Comparative Analysis of Alternatives in the revised FS, which is summarized in this section, compared the vitrification and chemical stabilization technologies.

5.2 Evaluation Criteria

Section 4 of the revised FS presents a comparative analysis of alternatives for the treatment of the Silos 1 and 2 material with respect to the nine evaluation criteria specified by the NCP to meet the requirements of CERCLA.

The NCP divides the evaluation criteria used in this comparative analysis into three categories: threshold, primary balancing, and modifying criteria. More detailed definitions of the evaluation criteria can be found in Section 3.1.2, Overview of the Detailed Analysis of the revised FS.

Threshold criteria consist of the two criteria that must be satisfied in order to be the selected alternative:

- Overall protection of human health and the environment; and
- Compliance with ARARs.

These criteria are of greatest importance in the comparative analysis because they reflect the key statutory mandates of CERCLA, as amended. An alternative must satisfy both of these *threshold criteria* before it is eligible to be selected as the final remedy.

Primary balancing criteria consist of the five criteria under which the relative advantages and disadvantages of the alternatives are compared to determine the best overall remedy:

- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability; and
- Cost.

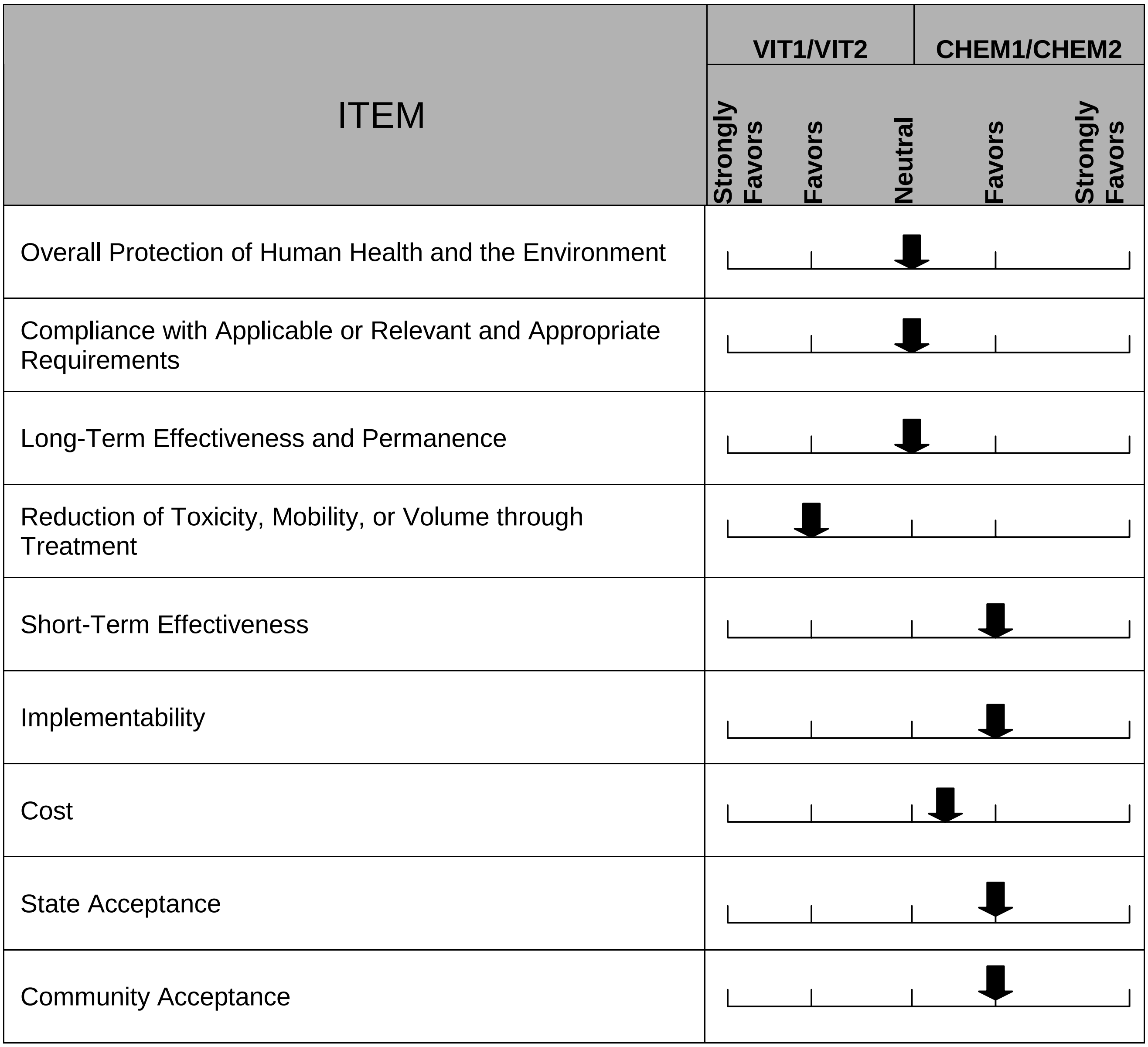
The first and second balancing criteria reflect the statutory preference for treatment as a principal element of the remedy and the bias against off-site land disposal of untreated material. Together with the third and fourth balancing criteria, they form the basis for determining the general feasibility of each potential remedy. In addition, the primary balancing criteria are used to determine whether costs are proportional to the overall protectiveness, considering both the remediation activity and the time period following restoration of the OU4 area. By this approach, it can be determined whether a potential remedy is cost-effective.

The final two criteria, identified in the NCP as *modifying criteria*, are state acceptance and community acceptance. These two criteria are evaluated based on input received from the state and public through comments on the revised FS and PP. These comments are addressed in this ROD Amendment in **Section 6** and **Appendix B**, respectively.

Figure 5.2-1 summarizes the comparative analysis of the alternatives.

FIGURE 5.2-1

COMPARATIVE ANALYSIS SUMMARY



The Comparative Analysis summarized in this section, is documented in detail in Section 4 of the revised FS.

5.2.1 Threshold Criteria

5.2.1.1 Overall Protection of Human Health and the Environment

Both vitrification and chemical stabilization provide overall protection of human health and the environment. Both alternatives limit exposure to contaminants by removing the sources of contamination, effectively treating the source materials to minimize the mobility of contaminants, and disposing the treated material in a protective manner off-site at the NTS.

The nature and extent of impacts to biota from implementing the technologies are similar. Each alternative involves site preparation and construction for a processing facility, removal of the silos material from the TTA, remediation of the silos material, and transport of the treated material to the NTS for disposal. Short-term impacts include the temporary loss of habitats at the FEMP site and possible impacts from accidental spills of construction and operation materials. Mitigative measures would be employed to minimize these short-term risks.

5.2.1.2 Compliance with ARARs

The vitrification and chemical stabilization technologies attain the threshold criterion of compliance with ARARs. A comprehensive list of ARARs is presented in **Appendix A** of this ROD Amendment. Key requirements are discussed in Section 3 of the revised FS within the evaluation of each alternative against this criterion. The following paragraphs summarize those evaluations.

Chemical-specific ARARs

Both vitrification and chemical stabilization technologies meet the chemical-specific ARARs associated with potential releases to groundwater, surface water, and air. The most critical chemical-specific ARAR is the radon flux limit (specified in the National Emissions Standards for Hazardous Air Pollutants, 40 CFR Part 61 Subpart Q) of 20 picoCuries per square meter·second (pCi/m^2·s). This limit applies to interim storage or final disposal of Silos 1 and 2 material. Both alternatives meet this ARAR during interim storage and after disposal. Both alternatives meet requirements for control of radon, particulate, and other air emissions from remedial activities by incorporating air emission treatment. The impact of radon emissions during remediation is evaluated as part of the short-term effectiveness criterion.

Location-specific ARARs

Vitrification and chemical stabilization technologies meet the location-specific ARARs as they relate to floodplains, wetlands, and endangered species and their habitats. Compliance with these alternatives is met through proper planning, siting, design, and operational procedures.

Action-specific ARARs

Vitrification and chemical stabilization technologies meet the action-specific ARARs identified for these alternatives. Appropriate engineering controls are implemented for each alternative to comply with Ohio Water Quality Standards and Air Quality Standards. Hazardous material transportation requirements are complied with by following the regulations under 40 CFR Parts 262 and 263, and the appropriate DOT shipping standards under 49 CFR Subchapter C Hazardous Materials Regulations.

5.2.2 Primary Balancing Criteria

5.2.2.1 Long-term Effectiveness and Permanence

Both vitrification and chemical stabilization technologies ensure long-term protectiveness of human health and the environment through treatment. Toxicity Characteristic Leaching Procedure (TCLP) analysis indicates that the vitrification and chemical stabilization process options evaluated during POP testing produced wasteforms that consistently met the NTS WAC and were durable based on leach rate data. The TCLP test is used to simulate the leaching effects of acidic groundwater infiltrating the disposal cell and contacting disposed waste. This test measures the ability of the stabilized waste particles to resist leaching even if the original wasteform (e.g. monolith) has been compromised.

Both alternatives include treatment that permanently reduces the leachability of COCs. Off-site disposal at the NTS provides additional protection by eliminating access to the treated materials and preventing migration of constituents from the materials. Location of the NTS disposal facility in a sparsely populated, arid environment reduces the potential for leachate generation, contaminant migration, and prevents direct contact with contaminants. Because the NTS is owned and maintained by DOE and used for the disposal of low-level wastes from other DOE sites, the uncertainties associated with institutional controls are minimal. As the result of a low average annual precipitation and depth to groundwater, impacts to human health and the environment from possible engineering and institutional controls failure are minimal.

There are no long-term environmental impacts at the FEMP site pertaining to the removal and treatment of Silos 1 and 2 material. The projected FEMP site residual risk to viable receptors is less than the NCP criterion of 10^{-6} ILCR, and non-carcinogenic effects are expected to be below 1.0 (HI) specified by the NCP for both alternatives. Long-term environmental impacts at the NTS involve some permanent disturbance of soils (i.e., acquisition of borrow material) associated with disposal activities. Significant long-term impacts are not expected to water quality or hydrology, air quality, biotic resources, socioeconomics or land use, or cultural resources. Wetland or floodplain areas have not been delineated at the NTS.

Long-term effects of waste disposal and necessary engineering and administrative controls that need to be incorporated into the design of the disposal cell will be determined based on results of a performance assessment (PA) conducted by the NTS. The NTS has previously conducted a PA on the Area 5 Radioactive Waste Management Site (Area #5). The PA resulted in the establishment of volumetric radionuclide concentration limits for acceptance for disposal in Area #5.

An informal review of the Area #5 PA indicates that chemical stabilized Silos 1 and 2 waste would meet the radionuclide concentration limits. Upon finalization of this ROD Amendment, a formal review of the treated Silos 1 and 2 waste against the Area #5 concentration limits will be conducted to determine if Area #5 at the NTS remains suitable for disposal of treated Silos 1 and 2 waste. If treated Silos 1 and 2 waste fail to meet the radionuclide concentration limits for Area #5, a PA specific to the characteristics associated with treated Silos 1 and 2 waste will be conducted by the NTS in accordance with DOE Order 435.1.

The three discriminating criteria for comparison of vitrification and chemical stabilization were determined to be reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost. **Figure 5.2-2** presents a summary of the comparison of the vitrification and chemical stabilization technologies against these criteria, as well as each criterion's subcriteria.

5.2.2.2 Reduction of Toxicity, Mobility, or Volume through Treatment

Overall, this criterion favors vitrification due to the reduction in treated material volume.

Figure 5.2-3 presents a comparison of the expected primary and secondary waste disposal volumes associated with the vitrification and chemical stabilization alternatives. This figure illustrates that, while vitrification results in a reduction in volume of the Silos 1 and 2 material, addition of the chemical fixatives and additives in the chemical stabilization process results in an increase in volume of the treated material compared to the volume of untreated material. Both of the technologies provide treatment that substantially reduces the mobility of COCs in the Silos 1 and 2 material through treatment. Toxicity Characteristic Leaching Procedure (TCLP) tests conducted on the treated surrogate material during POP testing indicate that either alternative can reduce the leachate concentrations of hazardous metals to below RCRA toxicity characteristic limits. Vitrification chemically binds the contaminants in a glass-like matrix that significantly reduces contaminant mobility. Chemical stabilization reduces the mobility of contaminants by converting the contaminants into a less soluble form and binding them into a stabilized matrix.

FIGURE 5.2-2

SUMMARY OF DISCRIMINATING CRITERIA AND THEIR COMPONENTS

ITEM
REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT
Treated Waste Volume
Secondary Waste Generation
Reduction in Mobility of COCs
Radon Attenuation by Treated Waste Form
SHORT-TERM EFFECTIVENESS
Worker Risk
Transportation Risk
Off-site/Environmental Impact
Time to Achieve Protection
IMPLEMENTABILITY
Scaleup
Commercial Demonstration
Operability
Ease of Acceleration
Constructability
COST

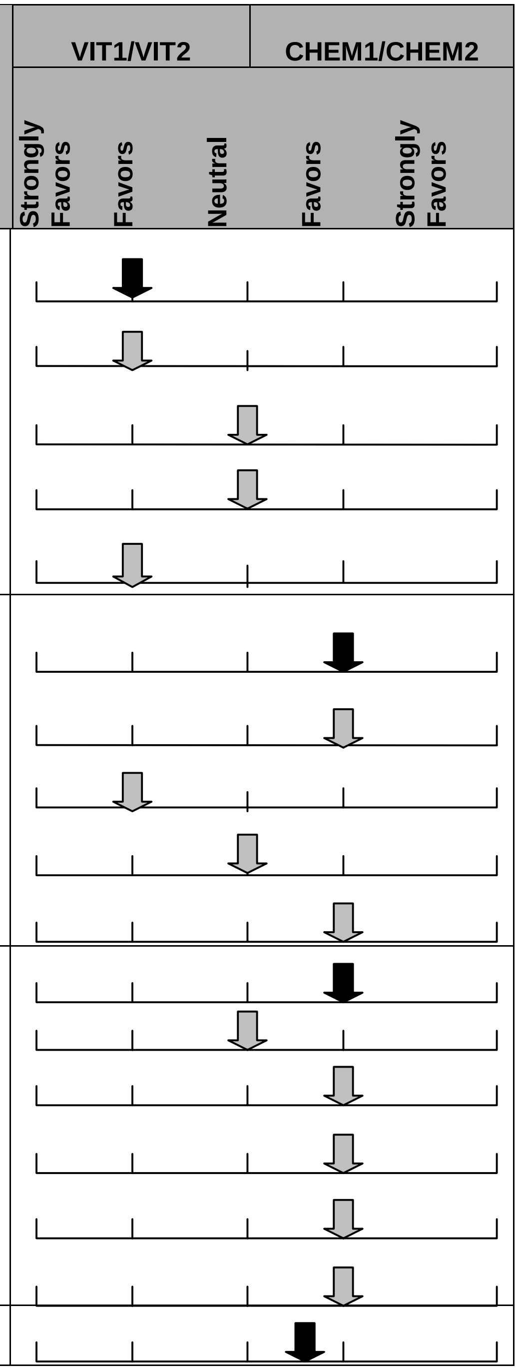


FIGURE 5.2-3

TOTAL SOLID WASTE VOLUME SUMMARY

The vitrified Silos 1 and 2 material reduces radon emanation more effectively than does the chemically stabilized material. However, the combination of radon mitigation provided by the chemically stabilized material plus the engineered barriers and packaging associated with the disposal of treated materials, effectively controls radon emanation. Both alternatives provide effective control of radon emanation from the treated Silos 1 and 2 material. The impact of radon emissions during remediation is evaluated as part of the short-term effectiveness criterion.

5.2.2.3 Short-term Effectiveness

The NCP identifies the components of short-term effectiveness as short-term risks to the community during implementation of the alternative; potential impacts to workers during RA; potential environmental impacts during implementation; and time until protection is achieved. Although each alternative is favorable in individual aspects of short-term effectiveness, from an overall perspective, this criterion favors chemical stabilization due to lower on-site worker risk and higher schedule certainty. The basis for determination of risks is detailed in Appendices B and E of the revised FS.

Worker Risk

Vitrification presents an increased non-radiological risk to the worker during on-site operations due to the greater number of person-hours estimated to complete remediation and increased physical hazards in the work place. An occupational hazard analysis was performed on the proposed design for each alternative (Appendix B of the revised FS). The hazard analysis evaluated the potential physical and chemical hazards to the workers involved with the on-site O&M activities. **Table 5.2-1** presents a summary of the discriminating hazards posed to workers as determined by the analyses of the alternatives.

TABLE 5.2-1

SUMMARY OF KEY HAZARDS TO ON-SITE WORKERS

Physical hazards due to vehicle and container movement	Greater hazard for chemical stabilization due to greater number of containers
Falls	Greater hazard for vitrification - more elevated equipment
Exposure to hazardous chemicals and toxicants	Greater hazard for vitrification - toxic constituents (SO_x, NO_x, lead - storage of caustic for scrubber, and gases)
Electrical shock	Greater hazard for vitrification - higher power requirements, more complex electrical system
Human hazards	Greater hazard for vitrification - greater number of work hours
High or changing pressure	Greater hazard for vitrification - remote potential for over-pressurization of the melter; potential releases from Emergency Off-gas System
Thermal hazards	Greater hazard for vitrification - high temperature in melter; handling of molten glass; high temperature off-gas
Spills/loss of containment	Greater hazard for vitrification - molten glass, toxic off-gas constituents, higher radon concentrations and caustic storage result in greater consequences for spills, leaks, etc.

The vitrification process liberates essentially all of the radon from the Silos 1 and 2 material during the treatment process. Chemical stabilization liberates less radon during the treatment process, but continues to generate radon during subsequent product handling operations. In both cases, sufficient radon control is provided to mitigate radon releases and attain environmental and worker protection limits. The calculated radon concentrations due to projected routine emissions for either alternative show no measurable impact to FEMP fenceline radon concentrations.

Both vitrification and chemical stabilization are able to meet the radon flux limit of 20 $pCi/m^2 \cdot s$ during interim storage at the FEMP and after disposal. Sufficient attenuation of radon is provided by the vitrified material without reliance on the packaging or disposal configuration. Although the chemical stabilization process provides attenuation of radon, it is reliant on packaging to meet the radon flux limit.

<u>Transportation Risk</u>

Appendix E of the revised FS evaluates the short-term risks associated with the transportation, both by direct truck and intermodal shipments, of the treated silos material to the NTS. The implementation of either transportation option presents a minimal risk to the public, within the CERCLA target risk range of $1x10^{-4}$ to $1x10^{-6}$. However, due to the greater number of shipments required to ship the larger volume of treated material, the transportation risk is incrementally higher for chemical stabilization.

For both technologies, transportation to the NTS complies with DOT regulations and DOE guidelines. The transportation of the Silos 1 and 2 material to the NTS by either truck or intermodal shipments is protective of human health and the environment. In addition, the anticipated shipping rate of 7 to 20 shipments per week does not represent a significant impact on total highway traffic.

<u>Off-site Environmental Impact</u>

Short-term impacts associated with both technologies include temporary disruption of several acres of land at the FEMP site for construction of the treatment facility and material handling. There is a potential for increased fugitive dust during construction activities; however, appropriate controls minimize the potential short-term impacts.

Time to Achieve Protection

Due to a shorter design-construction start-up period, and a more feasible schedule acceleration, chemical stabilization is preferred with respect to time to achieve protection. **Figure 5.2-4** presents a comparative summary of each alternative's schedule.

The time period between the approval of the ROD Amendment and the initiation of treatment operations (i.e., design, construction, construction acceptance testing, preoperations, and start-up) for the Silos 1 and 2 remediation is estimated to be 62 months for vitrification, compared to 54 months for chemical stabilization. The difference of eight months between the two schedules is primarily attributed to the time required, based upon lessons learned during start-up of DOE vitrification facilities, to perform Proof of Process testing during start-up of the vitrification facility. In addition, the technical risk evaluation results in a calculated schedule uncertainty of 14-16 months for vitrification compared to 8-10 months for chemical stabilization.

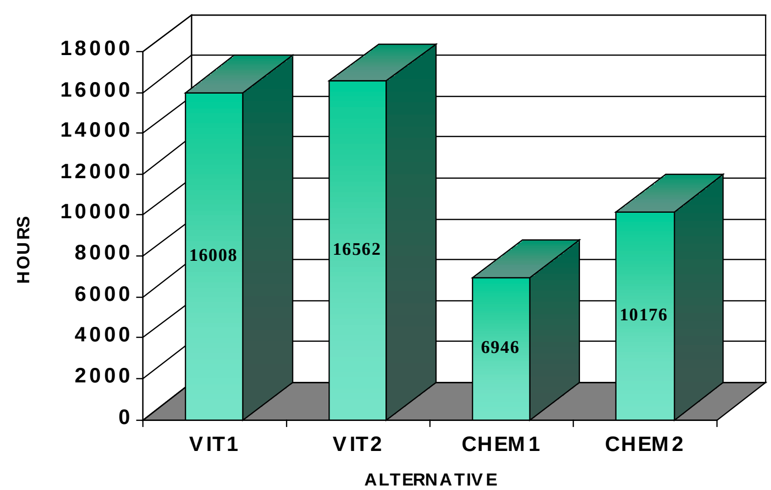
While vitrification requires full-time (24 hr/day, 7 days/wk) operation to complete treatment within the three-year period evaluated in the revised FS, chemical stabilization can complete treatment within three years with less than full-time operation (e.g., 16 hrs/day, 5 days/week and 24 hrs/day, 5 days/week). Less than full-time operation would leave 'excess' operating time (shifts per day or days per week) available to recover from unplanned downtime. This excess operating time results in higher confidence in the ability of the chemical stabilization alternative to complete treatment within a given timeframe. **Figure 5.2-5** presents the total operating hours required to treat the Silos 1 and 2 material in three years at the scale proposed by the POP vendors.

FIGURE 5.2-4

TIME TO ACHIEVE PROTECTION SCHEDULE COMPARISON

FIGURE 5.2-5

SUMMARY OF TOTAL REQUIRED OPERATING HOURS



5.2.2.4 Implementability

Overall, this criterion favors chemical stabilization due to a greater degree of commercial demonstration of the treatment technology, less complexity of integrated systems, and greater confidence in its ability to be successfully implemented.

Figure 5.2-6 summarizes the implementability analysis.

Both vitrification and chemical stabilization are difficult to implement because of the nature of the Silos 1 and 2 material, which requires remote operations. Although operational risks for both can be controlled, chemical stabilization is preferred because there is more demonstrated commercial experience with this technology. In addition, chemical stabilization is less complex than vitrification and therefore more certain in its ability to be successfully implemented; and, it offers greater opportunity for schedule acceleration and recovery in the event of unplanned downtime.

Both vitrification and chemical stabilization have encountered difficulties in treating radioactive wastes in the DOE-complex. However, there is significantly more demonstrated experience in the commercial sector on both radioactive, hazardous and mixed wastes with the chemical stabilization technology than with the vitrification technology. In addition, based on evaluation of existing facilities, the production rate required for the vitrification process to treat Silos 1 and 2 material within an acceptable timeframe is at the upper limit of the current capacities of existing vitrification facilities treating radioactive material. The production rate required for the chemical stabilization process is well within the limits of the capacity demonstrated by existing chemical stabilization facilities.

<END OF PAGE>

FIGURE 5.2-6

IMPLEMENTABILITY SUMMARY TABLE

ITEM	VIT1/VIT2 Strongly Favors	VIT1/VIT2 Favors	Neutral	CHEM1/CHEM2 Favors	CHEM1/CHEM2 Strongly Favors
Technical Feasibility					
Scaleup			↓		
Commercial Demonstration				↓	
Operability					
Ease of Operation				↓	
Reliability				↓	
Maintainability				↓	
Complexity				↓	
Ease of Acceleration				↓	
Constructability (Ease of Construction/Fabrication, Ease of D&D)				↓	
Administrative Feasibility (Licensing and Programmatic)			↓		
Availability of Services (Contractors, Equipment and Utilities)			↓		

To treat Silos 1 and 2 material within a three-year time period (assumed as a common basis for the comparative analysis), the vitrification process would have to produce 15 tons of vitrified material per day. Within the experience of the vitrification technology, there are no facilities in the DOE-complex and only two facilities (vitrification-other facilities) in the commercial sector operating at the required capacity. This limited experience at the required capacity results in increased uncertainty as to whether the current technology has the capability to treat Silos 1 and 2 material at the required capacity. In comparison, to treat Silos 1 and 2 material within a three-year time period, the chemical stabilization process would have to process 12 cubic yards (yd^3) of Silos 1 and 2 material per day. There have been a number of chemical stabilization facilities in both the DOE-complex and the commercial sector that have operated at the required capacity. Because there is a greater degree of commercial demonstration of the chemical stabilization process at the required capacity, there is less uncertainty in its ability to treat Silos 1 and 2 at the required capacity.

Vitrification has more unit operations associated with it than chemical stabilization and is therefore considered to be more complex to operate and maintain than chemical stabilization. The integrated operation of complex systems associated with the vitrification process increases the likelihood of process upsets and resulting downtime. In addition, the complexity of process control associated with vitrification complicates melter operation. Included in the complexity of the process control are critical parameters that are not readily measured, such as viscosity, electrical conductivity, liquidus temperature, and sulfate formation. Furthermore, as stated under the discussion of short-term effectiveness, the hazards inherent to the vitrification process incrementally increase the risk to the workers during maintenance activities, and make recovery from upsets more difficult.

The two vitrification processes propose to operate 24 hr/day for 7 days/wk for three years. The two chemical stabilization processes propose to operate 16 to 24 hr/day for 5 days/wk for three years. Based on the current designs, the chemical stabilization process has a better opportunity to improve schedule and accelerate remediation. In addition, based on current designs, the chemical stabilization has a better opportunity to recover from process upsets or other downtime.

Based on the above evaluation, chemical stabilization is the preferred alternative to implement. Chemical stabilization has a greater degree of commercial demonstration at the required capacity, is less complex to operate, and provides more opportunity to recover from process upsets and other downtime, as well as more opportunity to improve schedule.

5.2.2.5 Cost

The cost evaluation is based on estimates that were developed on information from the four preconceptual designs presented in Appendix G of the revised FS and the technology-specific POP testing information presented in Appendix H of the revised FS using a variety of cost-estimating methods.

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The cost estimates were developed for (1) capital costs; (2) O&M costs; (3) waste shipping and disposal costs; (4) D&D costs; (5) engineering costs; (6) project management costs; and (7) cost of borrowing money. The cost estimates are prepared so as to estimate and evaluate each cost element identified in the preconceptual design. Therefore, the accuracy of the estimates is a function of the preconceptual designs. The accuracy of all four estimates is considered +50/-30%, which is consistent with CERCLA guidance (EPA 1988). Given the fact that potential contractors will be given the opportunity to propose their unique designs based on their commercial experience, the actual design may change significantly. The subject accuracy establishes a range that is likely to capture that which is ultimately bid in response to a request for proposal to remediate the Silos 1 and 2 material and baselined following this ROD Amendment. All estimates were developed in fiscal year 1999 (FY99) dollars so that the alternatives with costs incurred over differing time periods can be evaluated on an equivalent basis.

Table 5.2-2 and Figure 5.2-7 summarize the major cost elements for the four processes.

<END OF PAGE>

TABLE 5.2-2

FEASIBILITY STUDY SUMMARY COST DATA (ALL ALTERNATIVES)

Alternative	Vitrification		Chemical Stabilization	
Process Option	VIT1	VIT2	CHEM1	CHEM2
Capital Cost	$69	$67	$55	$56
O&M Cost	$134	$133	$77	$83
Waste Disposal Cost	$25	$20	$58	$55
D&D Cost	$35	$38	$34	$36
Engineering Cost	$25	$25	$24	$24
Project Management Cost	$22	$22	$21	$21
Cost of Money	$46	$37	$28	$28
Summary cost (un-escalated)	$356	$342	$297	$303

FIGURE 5.2-7

FEASIBILITY STUDY COST COMPARISON

All four process options are cost effective; the costs appear proportional to the overall protectiveness provided by the alternatives, both during and following the remediation period. The cost differential between the vitrification and chemical stabilization alternatives is approximately 16%, with the cost of chemical stabilization being lower. The following discussion identifies the differences between the four alternatives for the key cost elements.

Capital Cost

Vitrification has a higher estimated capital cost than chemical stabilization due to the complexity of the process equipment. The need for sizeable interim storage areas for chemical stabilization partially off-sets the higher equipment costs of the vitrification alternative.

Operations and Maintenance Cost

Vitrification has a higher estimated O&M cost than chemical stabilization for the following reasons:

- Vitrification operations are on a 24 hr/day, 7 days/wk schedule;
- Vitrification requires an additional 8-month proof of process testing (full-scale surrogate operations);
- Vitrification has more expensive spare parts (specialized). Melter refractory life is limited and may need to be replaced during the 3 years of operation; and
- Vitrification uses more costly consumables (chemicals, supplies) and uses (electricity, natural gas).

Waste Shipping and Disposal Cost

Chemical stabilization has higher estimated packaging, transportation, and disposal costs than vitrification. The lower waste loading (chemical stabilization) produces a greater volume of treated material resulting in an increased number of disposal containers, shipments, and disposal volume.

D&D Cost

The D&D costs are roughly equivalent for both alternatives. Vitrification has a higher D&D cost due to the more complicated plant layout (multiple floors, equipment). However, the difference is offset by the D&D cost of chemical stabilization having more building debris to handle due to the larger interim storage facility.

Engineering Cost

Vitrification has a slightly higher estimated engineering cost than chemical stabilization due to the complexity of the process design.

Project Management Cost

Vitrification has higher estimated project management costs than chemical stabilization due to the vitrification schedule being longer, with project management being level-of-effort based on the schedule duration.

Cost of Money

Based on the contracting strategy planned for the remediation of the Silos 1 and 2 material, the contractor must borrow money to finance the design and construction effort, well in advance of being reimbursed in accordance with a predetermined pay item schedule. Since vitrification has a higher upfront capital cost investment, vitrification has a higher cost of borrowing money than chemical stabilization.

6.0 SUPPORT AGENCY COMMENTS

6.1 State Acceptance

The State of Ohio concurs with the selected remedy and the ARARs put forth in this ROD Amendment for the remediation of the OU4 Silos 1 and 2 material. **Tables 6.1-1** presents the OEPA comments issued during the formal public comment period and DOE responses to the comments.

<END OF PAGE>

TABLE 6.1-1

OEPA COMMENTS ISSUED DURING FORMAL PUBLIC COMMENT PERIOD

Item	Page/Section	Comment	Response
1	General	The OU4 Silos 1 and 2 Proposed Plan is the culmination of efforts by U.S. DOE, Ohio EPA, and U.S. EPA to understand and develop a plan for treating and disposing of the K-65 silos and their contents. Ohio EPA believes the alternative selected in the Proposed Plan is protective of human health and the environment. Ohio EPA supports the preferred alternative of chemical stabilization for the K-65 wastes. The preferred alternative is more implementable and will result in substantially less secondary wastes. Of significant importance to Ohio EPA during considering the alternatives is the release of radon gas during treatment. Ohio EPA believes the preferred alternative provides a substantial reduction in air pollution releases and increased reliability of emissions controls over the other alternative considered.	The DOE acknowledges OEPA's support of chemical stabilization as the preferred technology for the treatment of the Silos 1 and 2 material.

TABLE 6.1-1 (continued)

Item	Page/Section	Comment	Response
2		DOE should commit to including and/or developing real-time monitoring for discharges to the environment resulting from remedial actions. DOE should attempt to incorporate any new developments in real-time monitoring from the DOE Office of Science & Technology as well as the private sector. Data obtained from real-time monitors and any additional monitoring activities should be provided to the Ohio EPA and public in a timely manner.	As part of the remedial design activities for the Silos 1 and 2 remedial actions, a preliminary and final safety assessment will be conducted by DOE to establish the safety basis and design objectives for the construction and the operation of all remedial facilities. The safety basis includes those measures (i.e., procedures, training, monitoring equipment) necessary to ensure that facilities will be constructed and operated in a safe manner and in compliance with ARARs.

TABLE 6.1-1 (continued)

Item	Page/Section	Comment	Response
2 (cont.)			It is the DOE policy in its conduct of operations to require facility operations procedures to be developed and adhered to during all remedial actions. Training of personnel to those procedures will be paramount to ensure safe conduct of all operations. DOE and Fluor Fernald, Inc. have developed and maintain the necessary emergency plans and procedures to adequately define the emergency management program, provide guidance for all emergency responders, proper notification of the public, ensure adequate monitoring and performance for critical systems, and to meet all regulatory requirements. Developing a plan for the use of "real-time" monitoring is an integral part of the remedial design which will be developed in partnership with EPA and OEPA. Results of "real-time" radon monitoring are currently available through the Integrated Environmental Monitoring Program and the Fernald Website (www.fernald.gov). As the project develops, the Silos 1 and 2 Project will define occupational monitoring requirements, including "real-time" monitoring. These results will also be made available to the affected workforce. DOE expects to work closely with the EPA and OEPA to establish monitoring programs responsive to the environmental, public health, and occupational concerns regarding remediation of Silos 1 and 2 material.

TABLE 6.1-1 (continued)

Item	Page/Section	Comment	Response

Item	Page/Section	Comment	Response
3	General	DOE should attempt to incorporate pollution prevention activities whenever possible during the design and operation of the Silos 1 and 2 remedial action systems, including using this as a criterion in selection of a contractor. All available methods to reduce or eliminate discharges and releases should be considered during the design of the system. The consideration of reducing decontamination and demolition volumes and costs should be a part of the contractor selection and design activities.	It is DOE policy, in accordance with Executive Order 12856, whenever feasible to apply pollution prevention and waste minimization principles into the design and operation of all its facilities. Accordingly, the technical specification for the Request for Proposal to be issued for this project contains provisions for the future contractor to incorporate pollution prevention and waste minimization features during the design effort. One of the evaluation criteria to be used in selecting the future contractor is the degree to which his design exhibits minimization of primary and secondary wastestreams. As part of the CERCLA remedial design process, EPA and OEPA will have the opportunity to review and approve the Contractor's design.
4	General	DOE must ensure the public that their involvement will not be diminished during Remedial Design and Remedial Action (RD/RA). DOE should commit within the Record of Decision for OU4 Silos 1 and 2 to maintaining the exceptional on-going public involvement program during RD/RA.	The public has played a fundamental role in shaping the path forward for the Silos Project. DOE is committed to sustaining public involvement through completion of the Silos 1 and 2 RD/RA activities. The Record of Decision Amendment will reaffirm DOE's commitment to public involvement.

7.0 STATUTORY DETERMINATIONS

The NCP [40 CFR Section 300.430(f)(5)(ii)] specifies that a ROD shall describe the following statutory requirements as they relate to the scope and objectives of the action:

- How the selected remedy is protective of human health and the environment;
- How the remedy will comply with all ARARs established under federal and state environmental laws (or justify a waiver);
- How the remedy is cost-effective (i.e., provides overall effectiveness proportional to its costs);
- How the remedy will use permanent solutions and alternative technologies or recovery technologies to the maximum extent practicable; and
- How the remedy will satisfy the statutory preference for remedies that employ treatment that permanently and significantly reduces the toxicity, mobility, or volume of the hazardous substances, pollutants, or contaminants as a principle element, or if it is not satisfied, explain why a remedy providing reductions in toxicity, mobility, or volume was not selected.

In addition, CERCLA requires five year reviews to determine if adequate protection of human health and the environment is being maintained where RAs result in hazardous substances remaining on-site above health-based levels. A discussion is provided below on how the selected response actions for Silos 1 and 2 satisfy these statutory requirements.

7.1 Protection of Human Health and the Environment

The selected remedy achieves the requirement of being protective of human health and the environment by: (1) removing the sources of contamination, (2) treating and stabilizing the materials giving rise to the principle threats from Silos 1 and 2, (3) disposing of treated materials at an off-site location that provides the appropriate level of protectiveness; and, (4) remediating contaminated soils and debris to protective levels. The contents of Silos 1 and 2 and the Decant Sump Tank System will be removed and treated through a chemical stabilization process and disposed at the NTS. Chemical stabilization will immobilize these materials and inhibit leaching of contaminants to the environment when they are disposed. Concrete from Silos 1 and 2 structures will undergo gross decontamination, demolition, size reduction, and packaging before being shipped off-site for disposal at the NTS or an appropriate PCDF. Silos 3 and 4 concrete structures and other facilities (i.e., treatment facilities, RTS, superstructures) will be removed from OU4 and disposed of in a manner consistent with the approved OU3 ROD (FEMP 1996c). Contaminated soil will also be removed and disposed in a manner consistent with the approved OU5 ROD (FEMP 1996d).

Baseline cancer risks from current conditions exceed the 10^{-4} to 10^{-6} acceptable risk range. Under the future land use scenario of continued federal ownership, the residual cancer risk from Silos 1 and 2 will be reduced to less than 1×10^{-6}. There are no short-term threats associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the remedy.

7.2 Compliance with Applicable or Relevant and Appropriate Requirements

In accordance with Part 121 of CERCLA, the selected remedy will achieve a standard or level of control consistent with all Federal and State of Ohio ARARs and TBCs. The selected remedy will also be performed in accordance with all pertinent DOE Orders. **Appendix A** provides a listing of the chemical-, action-, and location-specific ARARs and TBCs that are invoked by this remedy.

Removal, treatment by chemical stabilization, and shipment for off-site disposal of Silos 1 and 2 material will be conducted in accordance with ARARs identified in this ROD Amendment. Concrete debris from Silos 1 and 2 will be disposed off-site at the NTS or an appropriate PCDF. Disposition of rubble and debris from Silos 3 and 4 and associated facilities (i.e., superstructures, treatment facilities, and the RTS) will be performed in accordance with the OSDF WAC, and will be conducted in accordance with the ARARs identified in the OU3 ROD. Disposition of soils from Silos 1 and 2 will be conducted in accordance with ARARs established in the OU5 ROD. Any interim storage of rubble and debris or soils, prior to final disposition under the RODs for OU3 and OU5, respectively, will be in accordance with ARARs identified in this ROD Amendment, pertinent DOE Orders, and applicable site procedures.

Silos 1 and 2 material destined for remediation is by-product material as defined under Section 11(e)(2) of the Atomic Energy Act of 1954, and as such, is excluded from RCRA regulation [40 CFR Section 261.4(a)(4)]. By-product material, as defined by the AEA, includes tailings or wastes produced by the extraction or concentration of uranium and thorium from any ore processed primarily for its source material content (42 U.S.C. 2014).

Since the Silos 1 and 2 material is excluded from regulation as solid or hazardous waste, the requirements under RCRA are not applicable to Silos 1 and 2 RAs. However, based on analytical data, the material is sufficiently similar to RCRA hazardous waste because Silos 1 and 2 material exceeds toxicity characteristic levels for various toxicity characteristic metals under RCRA. Therefore, certain substantive requirements of RCRA are relevant and appropriate for management of the Silos 1 and 2 material, and are included in the table of ARARs in **Appendix A**. The selected remedy will meet all relevant appropriate RCRA requirements.

7.3 Cost Effectiveness

The selected remedial alternative has been determined to be protective of human health and the environment, and to be cost effective. The estimated project cost for this remedy is approximately three-hundred (300) million dollars.

7.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

The EPA and the State of Ohio have determined that the selected remedy for Silos 1 and 2 represents the maximum extent to which permanent solutions and treatment technologies can be used in a cost-effective manner. Of the alternatives that are protective of human health and the environment and comply with ARARs, the EPA and the State of Ohio have determined that this selected remedy provides the best balance of tradeoffs among the alternatives in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume through treatment, short-term effectiveness, implementability, and cost. The selected remedy also meets the statutory preference for treatment as a principle element.

Chemical stabilization and off-site disposal will provide permanent treatment for the Silos 1 and 2 material. By chemically binding the contaminants into a chemical stabilization matrix, the mobility of the contaminants significantly reduces the leachability of metal contaminants of concern to levels that are below RCRA regulatory thresholds. As a result, the selected remedy would meet the CERCLA criteria for permanent solutions that reduce the toxicity, <u>mobility</u>, or volume through treatment.

7.5 Preference for Treatment as a Principal Element

The statutory preference for remedies that employ treatment as a principal element is satisfied. By treating the contents of Silos 1 and 2 in a chemical stabilization process, and providing for management, including treatment and disposal, of contaminated debris and soils consistent with the OU3 and OU5 RODs, the selected remedy mitigates the principal threats posed by OU4 through the use of treatment technologies. The treatment provided by chemical stabilization accomplishes a significant, permanent reduction in mobility of the COCs.

7.6 Irreversible and Irretrievable Commitment of Resources

Implementing the selected remedy will result in permanent commitment of on-property land and associated natural resource services for material disposal at the FEMP site and off-site at the NTS.

Soil at the FEMP site and the NTS will be disturbed by construction and excavation activities. Many impacts will be temporary, pending completion of remedial activities and restoration programs. The implementation of the selected remedy will temporarily disturb approximately 13,747 m^3 (17,981 yd^3) to 13,958 m^3 (18,257 yd^3) of soil at the FEMP site. All areas disturbed at the FEMP site will be regraded and revegetated.

Soil at the NTS will be permanently disturbed for the disposal of chemical stabilized Silos 1 and 2 material. However, disturbance of soil will be in an area previously designated by the NTS for low-level radioactive waste disposal (Area 5 Radioactive Waste Management Site) as evaluated in the NTS-EIS.

The area of the FEMP designated for Silos 1 and 2 remedial activities has already been industrialized, and does not provide a critical habitat for threatened or endangered species. Therefore, the short-term disturbance of land under the selected remedy is not anticipated to impact biotic resources. The desert tortoise is the only threatened or endangered species at the NTS. DOE-NV has evaluated the effects of the programs of the NTS-EIS on the desert tortoise. Because disposal of chemical stabilized Silos 1 and 2 material will be in an area previously designated for low-level radioactive waste disposal (Area #5), disturbance of land at the NTS is not expected to impact biotic resources.

The selected remedy is not anticipated to adversely impact wetlands and associated natural resource services. Long-term direct impacts to the floodplain resulting in changes of flood elevations will not occur. Engineering controls would be implemented to minimize or eliminate any indirect impacts. The NTS does not have any designated wetland areas or floodplain areas.

The implementation of this alternative is expected to have minor impacts on the surface water hydrology at the NTS. The NTS lies in an arid region with little rainfall; continuously flowing streams are nonexistent at the NTS.

Through erosion control and dust suppression, transport to adjacent surface water bodies of contaminants disturbed during remediation at the FEMP is not expected. Surface water near the site would be monitored during remediation in accordance with the existing National Pollution Discharge Elimination System permit to assess potential impacts to the water from remediation. Because material would always be contained, remediation activities would not be expected to increase the release of contaminants to the groundwater.

It is assumed that resources for remedial work will be purchased within the consolidated metropolitan statistical area (CMSA), resulting in a minor beneficial impact to the CMSA in the short-term. Furthermore, the removal of the Silos 1 and 2 material reduces impacts to population and economic growth in the area.

Since 1951, primary land use on the NTS has been nuclear weapons testing and low-level radioactive waste disposal for on-site and off-site DOE-affiliated generators. The NTS is surrounded on the east, north, and west sides by public access exclusion zones (e.g. Nellis Air Force Base Bombing and Gunnery Range). This area provides a buffer zone between the test areas and public lands of 24 to 105 kilometers (15 to 65 miles). The off-site areas adjacent to the NTS are predominantly rural; hence, aesthetic impacts are not expected to change. Therefore, disposal activities associated with the selected remedy do not impact socioeconomics or land use at the NTS.

8.0 COMMUNITY PARTICIPATION

8.1 Community Acceptance

Community acceptance is one of the criteria that DOE and EPA are committed to considering during the decision-making process for selecting a remedy for the Silos 1 and 2 material. The NCP specifies that the public must be provided the opportunity for input in selection of RAs. Specifically, the NCP [40 CFR Section 300.435(c)(2)(ii)] specifies that proposed amendments to the ROD and information supporting the decision be made available for public comment. This interaction with the community is critical to the CERCLA process and to making sound environmental decisions.

To augment public involvement throughout the decision-making process, the DOE-FEMP chartered the Critical Analysis Team (CAT). The CAT, which is comprised of three independent technical and process oriented leaders, is focused on evaluating the technical basis and objectivity of the development and evaluation of the remedial alternatives. Through their development, the revised Silos 1 and 2 FS, the PP, and this ROD Amendment, have considered input of the CAT. The CAT has provided independent feedback to the public on its technical evaluation of the documentation supporting this ROD Amendment (FS, PP, POP test reports).

During the decision-making process documented in this ROD Amendment, DOE has actively informed and solicited feedback from stakeholders. The DOE has sponsored several community briefings and workshops both locally and at the NTS to share the data supporting the evaluation of alternatives in the revised FS and PP. In addition, the DOE has sponsored formal public hearings regarding the PP both locally and at the NTS in an effort to provide the public a forum to provide verbal comments on the preferred alternative identified in the PP. **Table 8.1-1** presents a summary of these public involvement opportunities.

TABLE 8.1-1

SUMMARY OF PUBLIC INVOLVEMENT OPPORTUNITIES

Meeting Topic	Location/Date
Preliminary Screening of Alternatives	FEMP/December 1997
Presentation of Proof of Principle testing data	FEMP/July 13, 1999
Summary of Detailed Analysis of Silos 1 and 2 FS	FEMP/October 12, 1999
Fernald Citizens Advisory Board (FCAB)	FEMP/October 14, 1999
FS overview with FCAB	FEMP/November 4 and 6, 1999
Summary of Comparative Analysis of Silos 1 and 2 FS	FEMP/November 17, 1999
Nevada Test Site Citizens Advisory Board Summary of Silos 1 and 2 FS Comparative Analysis	Las Vegas, Nevada/December 1, 1999
FCAB Proposed Plan Summary	FEMP/December 6, 1999
Formal Public Hearing on Silos 1 and 2 PP	FEMP/April 25,2000
Formal Public Hearing on Silos 1 and 2 PP	Las Vegas, Nevada/May 3, 2000

The DOE and EPA have considered all public comments on the preferred alternative identified in the PP in preparing this ROD Amendment. All written and verbal comments received during the public comment period have been summarized and responded to in the *Responsiveness Summary* section of this ROD Amendment (**Appendix B**).

8.2 Community Participation

The community is encouraged to read and provide comments on the ROD Amendment for Silos 1 and 2. This ROD Amendment puts forth a selected RA alternative for the Silos 1 and 2 material based upon the content and conclusions of the FS and PP, as well as input provided by the EPA, OEPA, and stakeholders.

The revised FS for Silos 1 and 2, PP, ROD Amendment, and other supporting documents are available from the Administrative Record, located at the PEIC and at the EPA offices in Chicago, Illinois. Addresses for these Administrative Record locations are provided below.

The dates for the comment period have been announced in the local media and are posted at the Administrative Record locations; addresses and hours are as follows:

Public Environmental Information Center 10995 Hamilton-Cleves Highway Harrison, Ohio 45030	U.S. EPA Region V 77 W. Jackson Blvd. Chicago, Illinois 60604
513-648-7480	312-886-0992
Monday, 7:30 a.m. to 8 p.m. Tuesday – Thursday, 7:30 a.m. to 5 p.m. Friday, 7:30 a.m. to 4:30 p.m.	Monday – Friday, 8 a.m. to 5 p.m.

Your comments may be submitted by mail to:

Mr. Gary Stegner U.S. Department of Energy Fernald Area Office P.O. Box 398705 Cincinnati, Ohio 45239-8705	Mr. James A. Saric U.S. EPA, 5HRE 8J 77 W. Jackson Blvd. Chicago, Illinois 60604
513-648-3131	312-886-0992

The OEPA is participating in the RI/FS and RA processes at the FEMP. For additional information concerning the state's role in the cleanup process at the FEMP or regarding the specifics of the revised FS and PP contact:

Tom Schneider

Ohio Environmental Protection Agency
401 E. Fifth Street
Dayton, Ohio 45402-2911

513-285-6466.

For additional information on public participation activities related to the revised Silos 1 and 2 FS, PP, or the FEMP site, visit the DOE-FEMP website at http://www.fernald.gov/.

8.3 Post-ROD Amendment Community Participation

Historically, the public has played a fundamental role in shaping the path forward for the Silos Project. DOE will sustain the same level of public involvement throughout the implementation of the Remedial Design/Remedial Action (RD/RA) activities, as was proven effective during the revised FS/PP and ROD Amendment process.

DOE is committed to maintaining public involvement through completion of the Silos 1 and 2 RD/RA activities. Per requirements under the NCP (40 CFR Section 300.435), DOE at a minimum will:

- Upon completion of the final engineering design, prepare a fact sheet describing the RD (40 CFR Section 300.435).
- Provide a public briefing upon completion of the final engineering design and prior to the beginning of the RA (40 CFR Section 300.435).
- Continue to provide project status through the Monthly Progress Briefings.

<END OF SECTION>

9.0 BIBLIOGRAPHY

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). 1980. *U.S. Code*. Vol. 42, secs. 9601 - 9675.
[overview at http://www.epa.gov/superfund/whatissf/cercla.htm]

Fernald Environmental Management Project (FEMP). 1993a. *Remedial Investigation Report for Operable Unit 4*. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index Numbers Vol. I-III: U-006-304.15 – 17)

— 1993b. *Feasibility Study/Proposed Plan – Final Environmental Impact Statement (FS/PP-EIS) for Remedial Actions at Operable Unit 4.* DOE/EIS–0195D. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index No. Vol. I-IV: U-006-404.8 – 11; also includes *FS* Vol. I-IV U-006-404.13 - 16; *PP* U-006-405.3; and *RI* Vol. I-III U-006-304.15 - 17)

— 1994a. *Feasibility Study for Operable Unit 4.* Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index Numbers Vol. I-IV: No. U-006-404.13 –16)

— 1994b. *Proposed Plan for Remedial Actions at Operable Unit 4*. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index No. U-006-405.3)

— 1996a. *Operable Unit 4 Vitrification Pilot Plant.* Phase I Interim Treatability Study Report, Campaign 1, 40110-WP-0001, Rev. 0. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, Ohio. ([4]AR Index No. U-006-409.28)

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[4] Documentation of Remedial Investigation/Feasibility Study activities for each operable unit is made available for public review. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Administrative Records for the FEMP site are located at the Public Environmental Information Center (PEIC) in Harrison, OH. 513-648-7480.

— 1996b. *Operable Unit 4 Vitrification Pilot Plant.* Phase I Interim Treatability Study Report, Campaign 2, 40110-WP-0002, Rev. 1. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index No. U-006-409.29)

— 1996c. *Operable Unit 3 Record of Decision for Final Remediation Action*. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index No. U-005-501.9)

— 1996d. *Operable Unit 5 Record of Decision*. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index No. U-007-501.4)

— 1997a. *Operable Unit 4 Vitrification Pilot Plant.* Phase I Interim Treatability Study Report, Campaign 4, 40110-WP-0003, Rev. 0. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, Ohio. ([4]AR Index No. U-006-506.3)

— 1997b. *VITPP Melter Incident Final Report.* Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index No. U-006-506.2)

— 1998a. *Final Explanation of Significant Differences for Operable Unit 4 Silo 3 Remedial Action at the Fernald Environmental Management Project.* 40400-RP-0004. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index No. U-006-503.11)

— 1998b. *Waste Acceptance Criteria Attainment Plan for the On-Site Disposal Facility*. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index No. U-006-409.34)

— 1999a. *Revised Feasibility Study Report for Silos 1 and 2.* Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index Numbers Vol. I-IV: U-006-404.18 – 21)

— 1999b. *Revised Proposed Plan for Remedial Actions at Operable Unit 4*. Prepared under contract for the U.S. Department of Energy: Fernald Field Office, Fernald, OH. ([4]AR Index No. U-006-405.4)

National Environmental Policy Act (NEPA). 1969. *U.S. Code*. Vol. 42, sec. 4332. [http://www.tis.eh.doe.gov/nepa/policy.htm]

National Oil and Hazardous Substances Pollution Contingency Plan (NCP). lat. rev. 1990. *Federal Register* Vol. 55, No. 46. ([4]AR Index No. U-006-409.23) [http://www.epa.gov/oerrpage/oilspill/ncpover.htm]

Silos Project Independent Review Team (IRT). 1997. *Silos Project Independent Review Team Final Report.* Prepared for Fluor Fernald: Fernald, OH. ([4]AR Index No. U-006-506.4)

U.S. Department of Energy (DOE). 1996. *Work Plan for FEMP Removal Action No. 17 - Improved Storage of Soil and Debris.* ([4]AR Index No. R-028-204.11 for Work Plan; Addenda R-028-204.13 & 14)

— 1999. Office of the Deputy Assistant Secretary for Nuclear and Facility Safety. *Waste Vitrification Systems Lessons Learned*. Germantown, MD: Office of Engineering Assistance and Site Interface. ([4]AR Index No. U-006-409.11)

U.S. Environmental Protection Agency (EPA). 1988. Office of Emergency and Remedial Response. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. EPA540G89004. Washington, D.C.: Dept. of Commerce National Technical Information Service (NTIS). ([1]AR Index No. G-000-1101.2)

— 1991. *Consent Agreement as Amended under CERCLA Sections 120 and 106(a) in Matter of: U.S. Department of Energy Feed Materials Production Center, Fernald, Ohio*. Chicago, IL: Office of Public Affairs, Region 5. ([4]AR Index No. G-000-710.12)

— 1994. *Record of Decision for Operable Unit 4*. EPA ID OH6890008976; ROD ID EPA/ROD/R05-95/287. ([4]AR Index No. U-006-501.5)
[abstract at http://www.epa.gov/superfund/sites/rodsites/0504934.htm]

— 1997a. *RE: OU4 Post-ROD Changes*, letter from J.A. Saric (USEPA) to J.W. Reising (USDOE). ([4]AR Index No. U-006-409.17)

— 1997b. *Agreement Resolving Dispute Concerning Denial of Request for Extension of Time for Certain Operable Unit 4 Milestones* Chicago, IL: Office of Public Affairs, Region 5. Administrative Docket No. V-W-90-C-057. ([4]AR Index No. U-006-409.16)

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